The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 4, Issue 6, 2026

COMPARATIVE STUDY OF INTRADERMAL TRANEXAMIC ACID INJECTIONS AND PRP THERAPY IN THE MANAGEMENT OF MELASMA

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DOI: https://doi.org/10.5281/zenodo.20589216

Keywords
Melasma, Intradermal Tranexamic Acid (TXA), Platelet-Rich Plasma (PRP)

Article History
Received: 07 April 2026
Accepted: 19 May 2026
Published: 08 June 2026

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Abstract

Background: *Melasma is a common pigmentary disorder characterized by brown to grayish patches that typically appear on the face. It most often affects women in their middle years and is more prevalent among individuals with darker skin tones.*

Objective: *To determine and compare the clinical effectiveness of intradermal Tranexamic Acid injections and PRP therapy in melisma.*

Methodology: *The study was designed as randomized controlled trial of the total of 40 patients clinically diagnosed with facial melasma will be enrolled in the study. The inclusion criteria of participants are that age between 20–50 years' patients clinically diagnosed with facial melasma. The exclusion criteria of the participants are the pregnant or lactating women. patients with systemic illnesses. The self-structured questionnaire was use to compare the clinical effectiveness of intradermal Tranexamic Acid injections and PRP therapy in melasma.*

Results: *The participants (N=40). It shows that 35.0% of participants are 20–30 years old (14 people), 42.5% are 31–40 years old (17 people), and 22.5% are 41–50 years old (9 people). Overall, the largest group is the 31–40 year age range. There are two groups, and they are equal in size: TXA Injection includes 20 participants (50.0%) and PRP Therapy includes 20 participants (50.0%). Since both groups have the same number of participants, the treatment groups are well-balanced for comparison. The most common site is the cheeks, with 17 participants (42.5%). Full face is next, with 10 participants (25.0%). Forehead involves 9 participants (22.5%), while the upper lip has the fewest participants at 4 (10.0%). Overall, the frequencies sum to 40 (100.0%).*

Conclusion: *The study concludes that while PRP therapy may offer a slight edge in terms of the "glow" and speed of initial improvement, Intradermal Tranexamic Acid remains a highly accessible, cost-effective, and potent first-line injectable treatment. Often, the best clinical results are seen when these treatments are used as adjuncts to traditional topical therapies rather than as standalone replacements.*

INTRODUCTION

Melasma is a common acquired disorder characterized by hyperpigmented macules or patches that are most frequently found on the mandibular, malar, and Centro facial regions, forehead, nose, upper lip, and chin. Melasma is a widespread skin disorder that affects millions across the globe. Its occurrence differs greatly depending on factors like skin tone, ethnicity, and geographic region. Generally, people with darker

complexions, particularly those within Fitzpatrick skin types III to V, are more prone to developing melasma. This includes many individuals of Latin, American, South Asian, Southeast Asian, and Middle Eastern backgrounds. For example, among Southeast Asian women, the condition may affect up to 40%, whereas in Latin American populations, the rate ranges between 9% and 30%. These variations are mainly linked to differences in skin pigmentation and levels of sun exposure in different regions(1).

Pregnancy plays a major role, with melasma affecting approximately 15% to 50% of pregnant women, hence the traditional name "the mask of pregnancy." However, not every expectant mother develops it, suggesting that genetic susceptibility and environmental triggers are also key contributors. Indeed, about one-third of affected individuals report a family history of melasma, indicating a hereditary component. Climate and geography further shape melasma's prevalence. It is more frequently seen in tropical and subtropical areas, where sunlight is strong year-round. In Brazil, for instance, melasma makes up more than 8% of dermatology consultations and affects 15% to 35% of adult women in some regions. Similar observations have been recorded in countries such as India, Nepal, Saudi Arabia, and Iran, where it ranks among the top pigmentary disorders(2). Melasma is primarily caused by exposure to ultraviolet (UV) radiation from the sun, which plays a central role in its development and worsening. When skin is exposed to UV light, it triggers a complex biological response that increases melanin production—the pigment responsible for skin color. This process starts with UV radiation inducing the production of reactive oxygen species (ROS) that cause oxidative stress in skin cells. In response, the skin increases the production of alpha-melanocyte-stimulating hormone (alpha-MSH) and adrenocorticotropic hormone (ACTH), which bind to melanocortin 1 receptors (MC1-R) on melanocytes (the pigment-producing cells). This activation leads to the stimulation of genes and proteins involved in melanin synthesis(3).

It is frequently asymptomatic and the treatment is essential owing to cosmetic considerations. It is more prevalent in females, particularly in the pregnancy. It may be generically characterized as centro-facial, malar and mandibular. It is classified as epidermal, dermal, and mixed based on Wood's lamp examination.

The fundamental underlying pathophysiology is not fully known. Hormonal imbalance, particularly oestrogen in females, is regarded to be a major predictor. The greater occurrence in instances utilizing oral contraceptive pills (OCPs) further promotes the hormonal aetiology. Photosensitisation impact of some medicines, thyroid diseases and ovarian anomalies are also known to be connected with this appearance. Alpha melanocyte-stimulating hormone, corticotropin, interleukin 1, and endothelin 1 are all produced in response to ultraviolet (UV) radiation from sunshine, which is one of the most widely accepted causes of enhanced melanin synthesis by intra-epidermal melanocytes.

The diagnosis is typically clinical and on examination. There is hyperpigmentation that is generally tan or blue and heavy history of OCPs usage or pregnancy is usually indicative. Supportive treatments including avoidance of sun-exposure and use of particular sun-blocks may be beneficial in slowing the development of illness, but definitive therapy necessitates active intervention; for which, numerous medications have been attempted with variable degree of success rate and adverse effect profiles. Platelets are abundant in poly type granules, which may lead to a cascade of events. The primary pathophysiology depends on prostaglandins E2 (PGE2) and extracellular kinases acting differently to suppress melanin production. A fibrinolytic agent with anti-plasmin qualities is tranexamic acid. Tranexamic acid may suppress the paracrine melano genic factors that typically operate to activate melanocytes.

Histological studies show that in melasma, melanin accumulates not only in the basal and suprabasal keratinocytes of the epidermis but also in dermal macrophages around small blood vessels. UV radiation also contributes to damage and breakdown of the basement membrane (between the epidermis and dermis) by increasing

matrix metalloproteinases (MMPs) that degrade collagen types IV and VI. This damage facilitates pigment "dropping" into the dermis, making pigmentation deeper and harder to remove. Chronic sun exposure also leads to solar elastosis a degeneration of the dermal elastic tissue, which contributes to the texture and appearance of melasma-affected skin(4).

Clinically, melasma is characterized by symmetrical, irregularly shaped, light to dark brown macules (flat patches) on sun-exposed areas of the face including the cheeks, forehead, upper lip, and chin. These patches may be confluent or punctate in appearance. The condition is benign and non-inflammatory, but it can cause significant psychological distress due to its cosmetic impact. Melasma often worsens with continued sun exposure and may fluctuate with hormonal changes such as pregnancy or contraceptive use(5).

Evaluation of melasma may include Wood's lamp examination to determine the depth of melanin deposition, epidermal pigmentation often appears enhanced under the lamp, while dermal pigment does not. Knowing the pigment depth helps in selecting the appropriate treatment approach. Unlike other hyperpigmentation disorders, melasma typically has minimal inflammation, but subtle vascular changes from UV-induced angiogenesis may also contribute to lesion color and appearance(6).

Melasma mostly happens after puberty, showing that female hormones play a big role in causing it. It often affects women of childbearing age. Using birth control pills, being pregnant, or using hormone creams can start or worsen melasma. In people with melasma, certain hormone levels like estrogen (especially E2), follicle-stimulating hormone (FSH), and luteinizing hormone (LH) are higher. The skin in melasma patches has more estrogen and progesterone receptors, which means these hormones help melasma form by increasing melanin production in skin cells called melanocytes. Even though estrogen is important, other factors also affect melasma, and sometimes anti-estrogen drugs do not stop it. Men get melasma less often, but hormone imbalances may still be a factor. Some studies also found links between melasma and thyroid problems or liver disease, but more research is needed to understand these connections. Traditional Chinese medicine thinks melasma is related to liver and kidney imbalances(7).

Melasma affects people of all ethnic backgrounds, but it is more common in Asians, Indians, Latin Americans, and African Americans. People with a family history of melasma are more likely to develop it. In some populations, more than 40% of patients have close relatives with melasma. Some genetic factors related to skin pigmentation and melanin production have been identified, but more studies are needed to fully understand the genetic causes of melasma(8).UV rays, air pollution, and normal body processes produce free radicals, which damage skin cells in a process called oxidative stress. This damage helps cause and keep melasma pigmentation. Antioxidants like vitamin C and glutathione (GSH) help protect skin cells from this damage and may help treat

melasma. Hydrogen treatment, which reduces free radicals, has helped other skin diseases and may become a future melasma treatment(9). Treatments like pulsed-dye laser target blood vessels and have shown good results, especially when combined with other pigment-reducing treatments(10). Platelet-rich plasma (PRP) serves as an effective treatment for melasma, reducing pigmentation through intradermal injections that release growth factors inhibiting melanin production. PRP is prepared from the patient's own blood and processed through centrifugation to increase the number of platelets, usually making it 3–5 times more concentrated than normal blood levels. Platelet-rich plasma (PRP) is a small amount of blood taken from a patient that's been specially processed to contain a high concentration of platelets. One important growth factor in PRP is called Transforming Growth Factor-Beta (TGF-β1). It's released from the platelets and has been found to slow down the production of melanin, the pigment that causes dark spots. It does this by influencing the signals inside skin cells that control pigment production. This is a key reason why PRP treatments can help

lighten melasma and improve skin tone(11).

Tranexamic acid is a synthetic version of the amino acid lysine. It works by preventing plasminogen from changing into plasmin, which helps slow down the breakdown of blood clots. By blocking this step, tranexamic acid helps strengthen and stabilize the network that holds clots together. When it comes to melasma, tranexamic acid has an additional important effect. After your skin is exposed to UV rays, certain skin cells called keratinocytes increase plasmin activity, which can lead to more pigmentation. Tranexamic acid stops plasminogen from attaching to these skin cells, reducing plasmin activity. This causes less arachidonic acid to be released, which means fewer prostaglandins are made, and the activity of tyrosinase (an enzyme that helps produce melanin) goes down. Since tyrosinase plays a big role in skin pigmentation, reducing its activity helps lighten melasma and improve skin tone(1).

Managing melasma starts with strict sun protection using broad-spectrum sunscreens that block UVA, UVB, and visible light, plus wide-brimmed hats and avoiding peak sun hours—without this, treatments fail and spots return quickly. For stubborn cases, oral tranexamic acid inhibits pigment pathways and blood vessels effectively under doctor supervision, while procedures like chemical peels (glycolic or salicylic acid) or cautious lasers/IPL serve as backups by exfoliating skin or targeting melanin, best after topicals and by melasma experts. Ongoing maintenance with sun protection and mild lighteners prevents relapse in this chronic condition, so educate patients on slow results, triggers like hormones/sun, and the need for patience and consistency(12).

The severity of melasma can be measured using the modified melasma area and severity index (mMASI) which relies upon the area and darkness of melasma. Treatment of melasma is complicated with a plethora of treatment techniques available, including topical depigmenting agents, systemic medications such as tranexamic acid, chemical peeling agents and usage of Q- switched Neodymium doped Yttrium Aluminium Garnet (Nd-YAG) laser. Intradermal tranexamic acid (TXA) and platelet-rich plasma (PRP) are the two developing therapy methods which have distinct mechanisms of action but both have demonstrated promising outcomes in melasma.

The enhanced plasmin activity in keratinocytes after UV exposure is linked to an elevated amount of melanocyte-stimulating hormone. TXA, a synthetic derivative of lysine, inhibits this UV- induced plasmin activity and decreases the levels of vascular endothelial growth factor (VEGF), hence lowering pigmentation. There are many ways to treat melasma, including intradermal, topical, and oral, with different doses and concentrations showing promising outcomes.

Obtained by centrifuging autologous blood and then suspending the platelets to release platelet-derived growth factor, platelet-rich plasma (PRP) is a small volume of autologous plasma with a high concentration of platelets. PRP improves melasma and increases skin volume through angiogenesis and collagen synthesis. Study has shown that the release of Transforming growth factor beta (TGF-β1) from platelet α-granules significantly reduces melanin formation by delaying the activation of extracellular signal-regulated kinase.

PRP, or platelet-rich plasma, is a kind of autologous plasma that is spun from blood. Reducing pigmentation and improving skin quality in terms of wrinkle reduction, improved elasticity, and skin hydration are outcomes of growth factors found in platelet alpha granules. These growth factors include transforming growth factor beta 1 (TGF-B1), which inhibits melanin synthesis, and platelet-derived growth factor (PDGF), which increases angiogenesis, collagen synthesis, and extracellular matrix formation.

A synthetic lysine derivative called tranexamic acid blocks lysine binding sites on plasminogen molecules, which inhibits plasminogen activation, anti-fibrinolytic effects, and secondary hemostasis by stabilizing the preformed fibrin meshwork and preventing plasminogen from interacting with plasmin and fibrin. It targets melasma by blocking the plasmin activity of keratinocytes in response to ultraviolet radiation.

Tyrosinase activity and prostaglandin production are both aided by a decrease in free arachidonic acid, which may be achieved by blocking plasminogen's binding to keratinocytes.

Centro facial, mandibular, and malar melasma patterns were seen clinically. In order to define the kind of melasma (dermal or mixed), a dermoscopic examination was performed using a DermLite 5 dermatoscope in contact polarized mode at tenfold magnification and UV light. The mMASI score was computed on each side. In a consistent setting with same lighting and distance, the same doctor captured both the clinical and dermoscopy images using an iPhone 13. Tests for thyroid function, total blood count, hemorrhage, and coagulation profile were administered to all patients. Following assessment, participants had a series of six injections, each lasting two weeks, of 10 mg/mL intradermal TXA administered using an insulin syringe on the right side and intradermal PRP on the left side. The next step was to check in with the patients again two weeks after their previous session.

The right side of the face got intradermal injection with tranexamic acid using 100U/ml insulin syringe, Tranexamic acid was obtained from Kapron® Ampoules, Amoun Phar maceutical Company, with a concentration of 100 mg/ ml. About 4 mg of tranexamic acid were drawn into a 100U/ml insulin syringe and diluted with saline to a volume of 1 ml in order to achieve the concentration of 4 mg/ml. A topical anesthetic cream (Emla 5% cream, AstraZen eca Pharmaceutical Company) was applied to the face and left for 30 min. Intradermal injections of
0.05 ml to a maximum of 8 mg were administered to the whole afflicted region at intervals of 1 cm.

The antecubital vein was used to take five milliliters of venous blood, which was then aseptically deposited in tubes containing sodium citrate 3.2% for anticoagulation. The first spin was conducted at 3000 rpm for 7 minutes. Subsequently, the buffy coat top layer was transferred to empty sterile tubes. The second spin was then performed at 4000 rpm for 5 minutes. To homogenize the platelet pellets, we mixed them completely with the lowest one-third volume of plasma and discarded the top two-thirds. Injectable PRP was subsequently aspirated. The study shows that melasma is a common, recurring skin pigmentation disorder, especially prevalent in Asian skin types, and no single treatment is fully effective yet. Newer treatments like Tranexamic Acid (TXA), which reduces melanin production, and Platelet-Rich Plasma (PRP), which helps regenerate the skin, are showing promising results. However, there is limited research directly comparing these two therapies. A comparative study is needed to find out which treatment
better controls pigmentation, has fewer side effects, and provides longer-lasting results. This will help doctors choose the best therapy for melasma patients and improve overall treatment outcomes.

OBJECTIVE(S)

1. To compare the clinical effectiveness of intradermal Tranexamic Acid injections and PRP therapy in melasma.
2. To evaluate and compare the outcomes of both treatments.

MATERIAL AND METHODS

Study Design: This study will be designed as randomized controlled trial.

Settings: Data will be collected from: Multi aesthetic and dermatology clinics, where individuals with melasma commonly seek consultation.

Study Duration: The total duration of the study will be 4 months.

Sample Size: A total of 40 patients clinically diagnosed with facial melasma will be enrolled in the study.

Sampling Technique: Patients will be selected using a randomized convenient sampling method, ensuring feasibility while maintaining randomness.

Sample Selection:

Inclusion Criteria:

1. Age between 20–50 years.
2. Patients clinically diagnosed

with facial melasma

Exclusion Criteria:

3. Pregnant or lactating women
4. Patients with systemic illnesses.

Study Groups:

Group A: Patients receiving Tranexamic Acid (TXA) injections.

Group B: Patients receiving Platelet-Rich Plasma (PRP) therapy.

DATA COLLECTION PROCEDURE

Data will be collected from clinically diagnosed melasma patients after obtaining informed consent. Demographic details such as age, occupation, and duration of melasma will be recorded using a structured proforma. Patients will be divided into two groups: Group A receiving Tranexamic Acid (TXA) injections and Group B receiving PRP therapy. Baseline assessment of melasma severity will be done using the Melasma Area and Severity Index (MASI) score before starting treatment. Clinical photographs will be taken under similar lighting conditions for documentation. After completion of treatment sessions, MASI scores will be reassessed. Patient satisfaction and side effects will be recorded through a questionnaire. All collected data will be kept confidential and coded for analysis.

DATA ANALYSIS PROCEDURE

The collected data will be entered into Microsoft Excel / SPSS for analysis. Descriptive statistics such as mean, frequency, and percentage will be used to summarize demographic data and clinical findings. Pre- and post-treatment MASI scores of both groups will be compared to assess treatment effectiveness by using the Independent-Samples T-Test. The difference in outcomes between TXA and PRP groups will be evaluated using appropriate statistical tests. A p-value < 0.05 will be considered statistically significant. Results will be presented in the form of tables, charts, and graphs.

RESULTS

Participant Age		
	Frequency	**Percent**
20–30 Year Old	14	35.0
31–40 Year Old	17	42.5
41–50 Year Old	9	22.5
Total	40	100.0

Table 1. Participant Age.

This table describes the age distribution of the participants (N=40). It shows that 35.0% of participants are 20–30 years old (14 people), 42.5% are 31–40 years old (17 people), and 22.5% are 41–50 years old (9 people). Overall, the largest group is the 31–40 year age range.

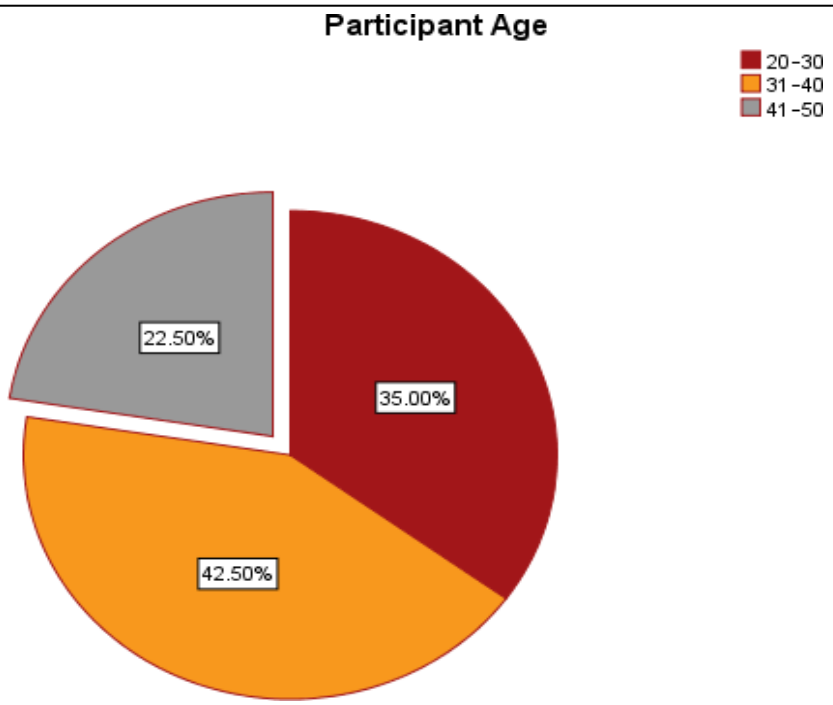

Figure 1. Pie Chart of Participant Age.

Treatment Group		
	Frequency	**Percent**
TXA Injection	20	50.0
PRP Therapy	20	50.0
Total	40	100.0

Table 2. Treatment Group.
This table shows the distribution of participants by treatment group (N=40). There are two groups, and they are equal in size: TXA Injection includes 20 participants (50.0%) and PRP Therapy includes 20 participants (50.0%). Since both groups have the same number of participants, the treatment groups are well-balanced for comparison.

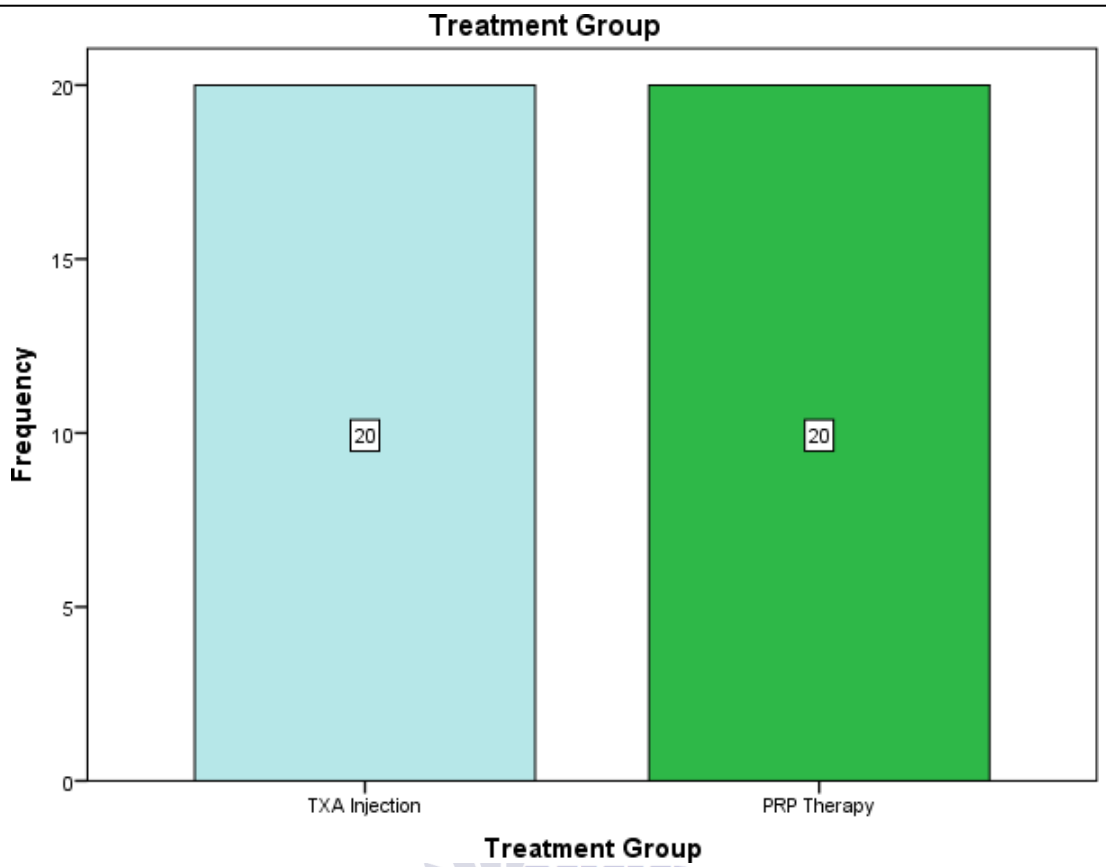

Figure 2. Bar Chart of Treatment Group.

Participant Gender		
	Frequency	**Percent**
Male	6	15.0
Female	34	85.0
Total	40	100.0

Table 3. Participant Gender.

This table shows the gender distribution of the participants (N=40). Female participants make up the majority: 34 participants (85.0%). Male participants are 6 participants (15.0%). In total, the sample includes 40 participants, with percentages adding up to 100.0%.

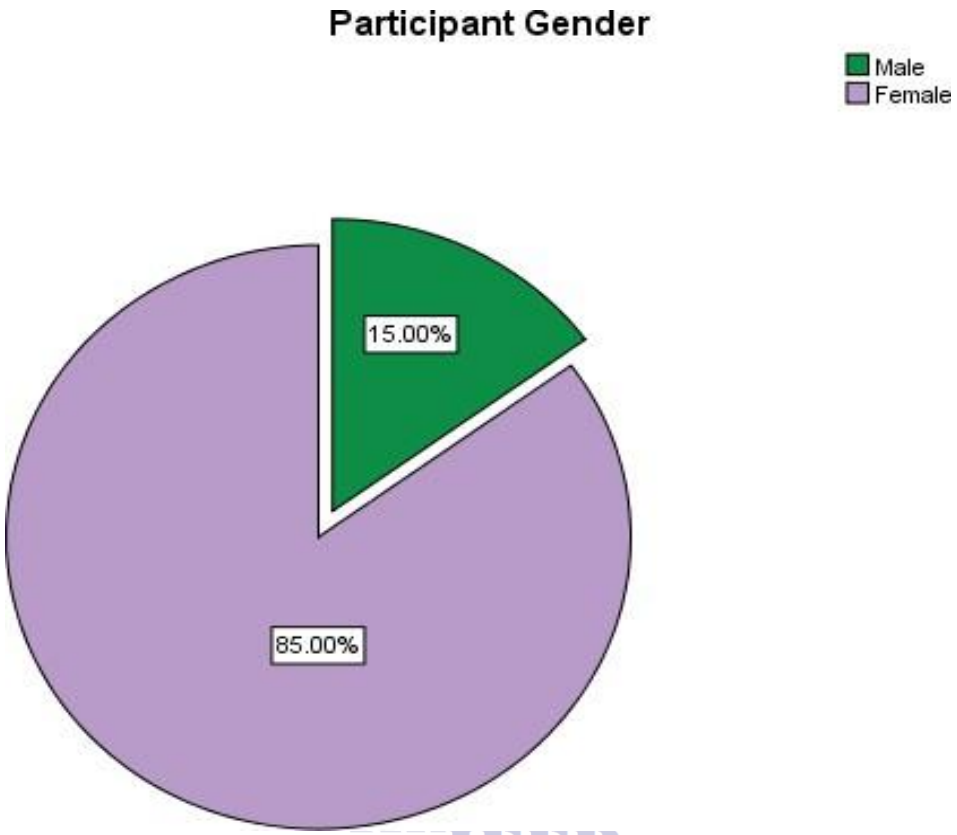

Figure 3. Pie Chart of Participant Gender.

Participant Occupation		
	Frequency	**Percent**
Indoor	21	52.5
Outdoor	19	47.5
Total	40	100.0

Table 4. Participant Occupation.
This table shows the participants' occupation type distribution (N=40). Indoor workers account for 21 participants (52.5%), while Outdoor workers account for 19 participants (47.5%). Overall, the totals add up to 40 participants (100.0%), with the largest group being indoor participants.

Figure 4. Bar Chart of Participant Occupation.

Participant Skin Type		
	Frequency	**Percent**
Dry	7	17.5
Oily	11	27.5
Combination	14	35.0
Sensitive	8	20.0
Total	40	100.0

Table 5. Participant Skin Type.

This table shows the distribution of participants by skin type (N=40). The largest group is Combination skin with 14 participants (35.0%). Oily skin accounts for 11 participants (27.5%), Sensitive skin for 8 participants (20.0%), and Dry skin for 7 participants (17.5%). Altogether, the frequencies add up to 40 (100.0%).

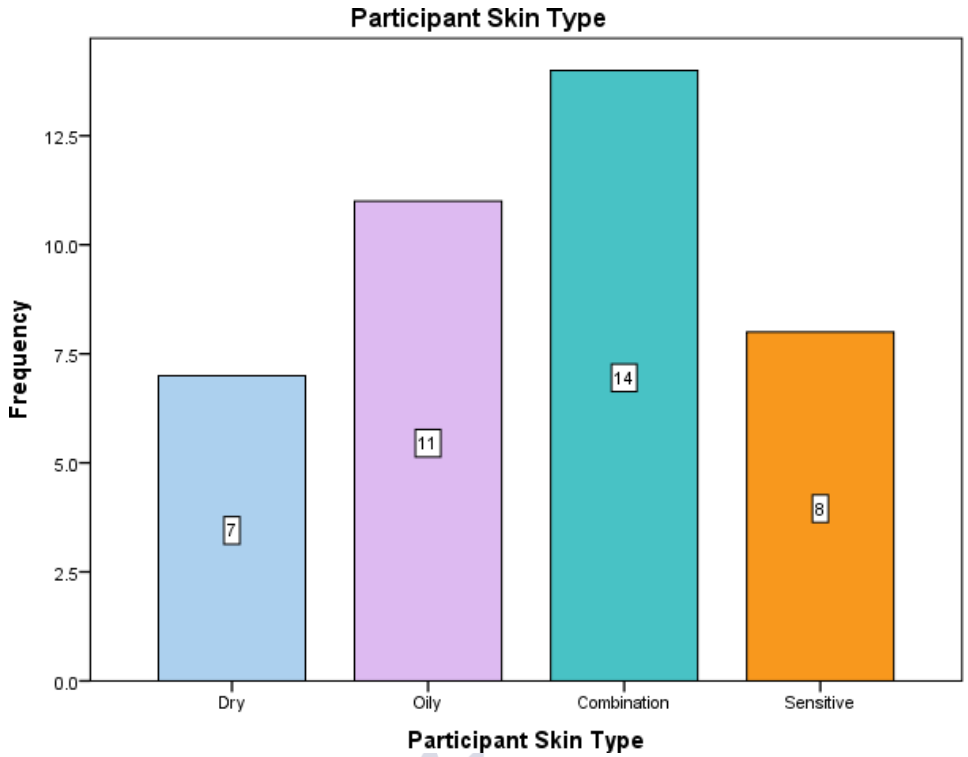

Figure 5. Bar Chart of Participant Skin Type.

Duration of Melasma		
	Frequency	**Percent**
<6 months	7	17.5
6–12 months	10	25.0
1–3 years	14	35.0
>3 years	9	22.5
Total	40	100.0

Table 6. Duration of Melasma.

This table shows the distribution of participants based on the duration of melasma (N=40). The largest group is those with melasma lasting 1–3 years, with 14 participants (35.0%). Next, 6–12 months' accounts for 10 participants (25.0%), followed by more than 3 years with 9 participants (22.5%). The smallest group is less than 6 months, with 7 participants (17.5%). Overall, the totals add up to 40 participants (100.0%).

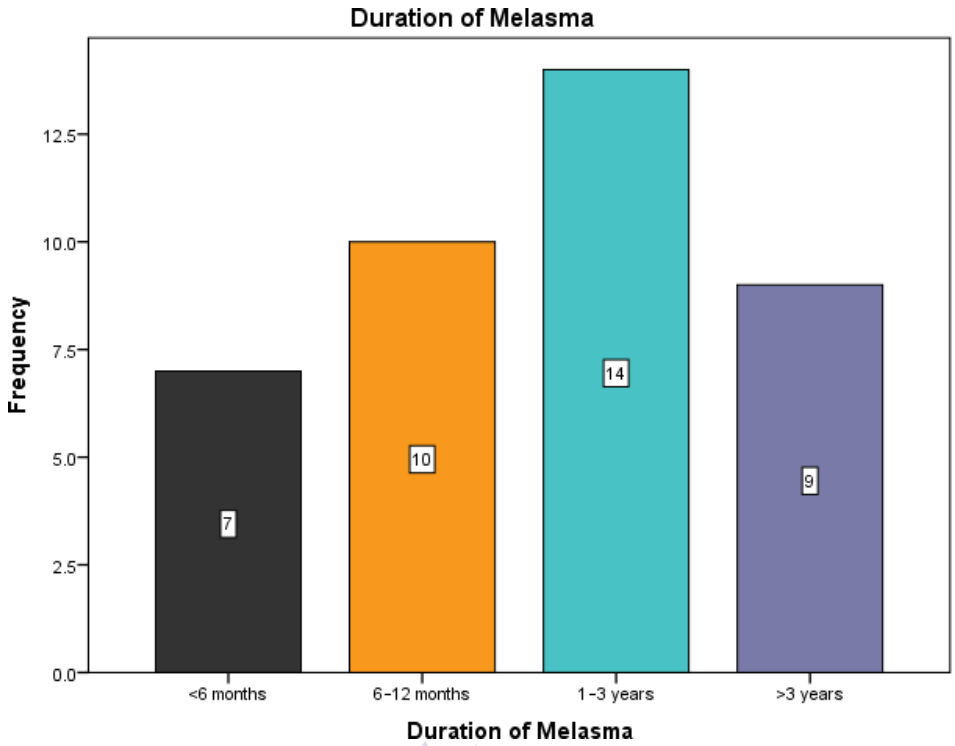

Figure 6. Bar Chart of Duration of Melasma.

Site of Melasma		
	Frequency	**Percent**
Cheeks	17	42.5
Forehead	9	22.5
Upper Lip	4	10.0
Full Face	10	25.0
Total	40	100.0

Table 7. Site of Melasma.
This table shows the distribution of participants by the site of melasma (N =40). The most common site is the cheeks, with 17 participants (42.5%). Full face is next, with 10 participants (25.0%). Forehead involves 9 participants (22.5%), while the upper lip has the fewest participants at 4 (10.0%). Overall, the frequencies sum to 40 (100.0%).

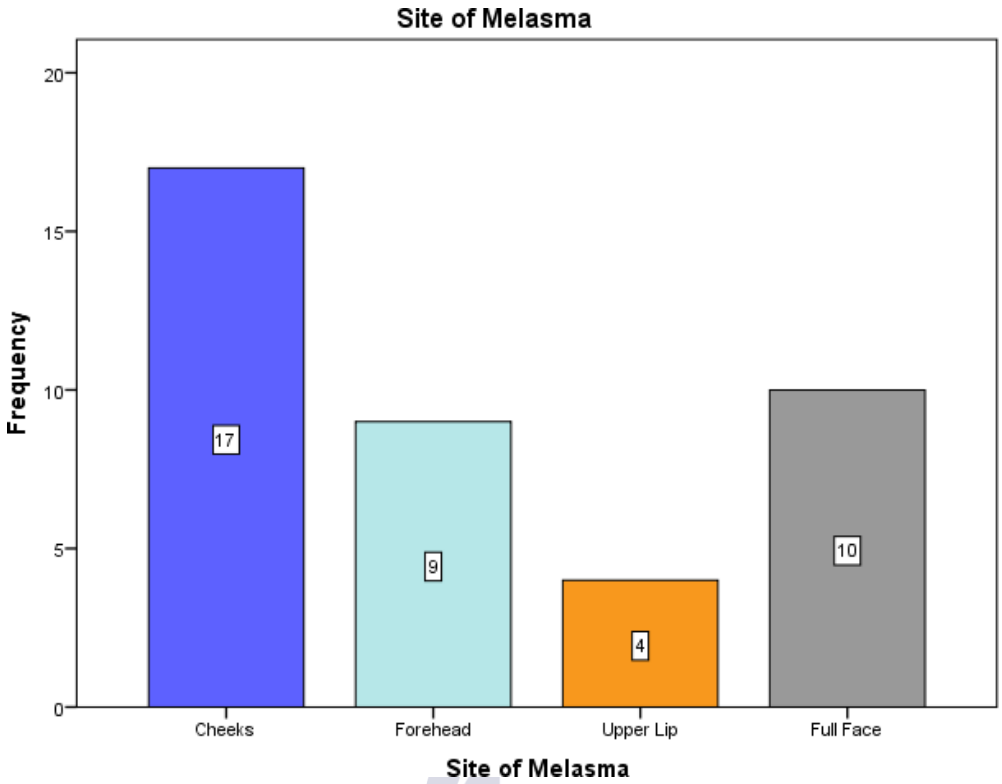

Figure 7. Bar Chart of Site of Melasma.

Family History of Melasma		
	Frequency	**Percent**
No	23	57.5
Yes	17	42.5
Total	40	100.0

Table 8. Family History of Melasma.
This table presents participants' family history of melasma (N=40). Most participants (23; 57.5%) reported no family history of melasma, while 17 participants (42.5%) reported yes, indicating that a substantial portion of the sample has melasma in their family. The total adds up to 40 (100.0%).

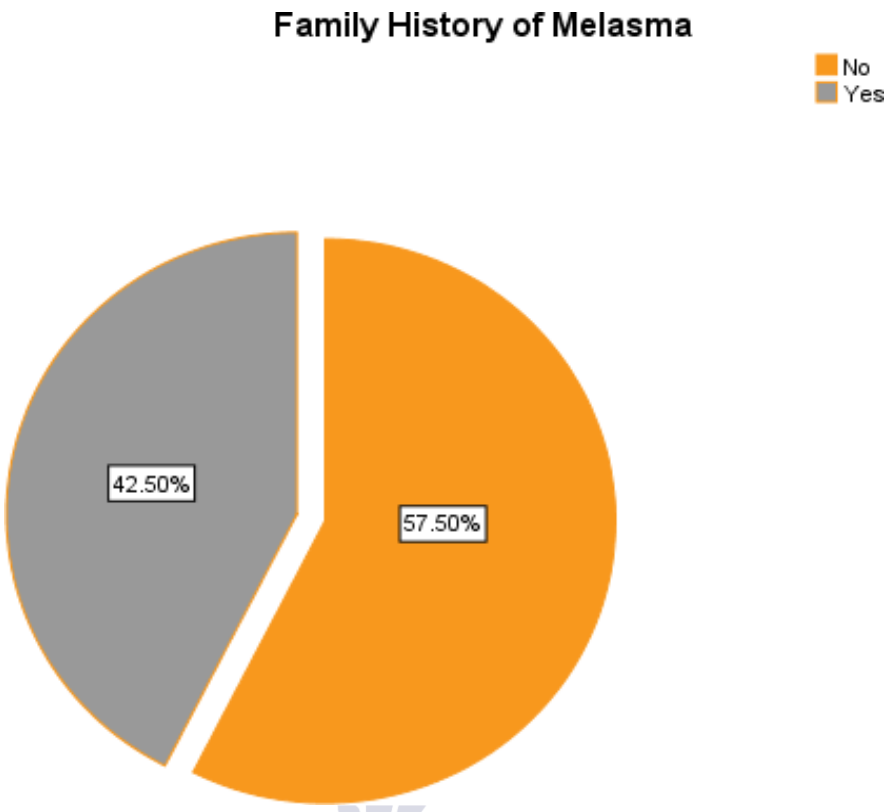

Figure 8. Pie Chart of Family History of Melasma.

Sun Exposure per Day		
	Frequency	**Percent**
<1 hr	12	30.0
1–3 hrs	19	47.5
>3 hrs	9	22.5
Total	40	100.0

Table 9. Sun Exposure per Day.
This table shows the distribution of participants by sun exposure per day (N=40). The largest group is those with 1–3 hours of sun exposure: 19 participants (47.5%). Less than 1 hour accounts for 12 participants (30.0%), while more than 3 hours includes 9 participants (22.5%). Overall, the totals add up to 40 participants (100.0%).

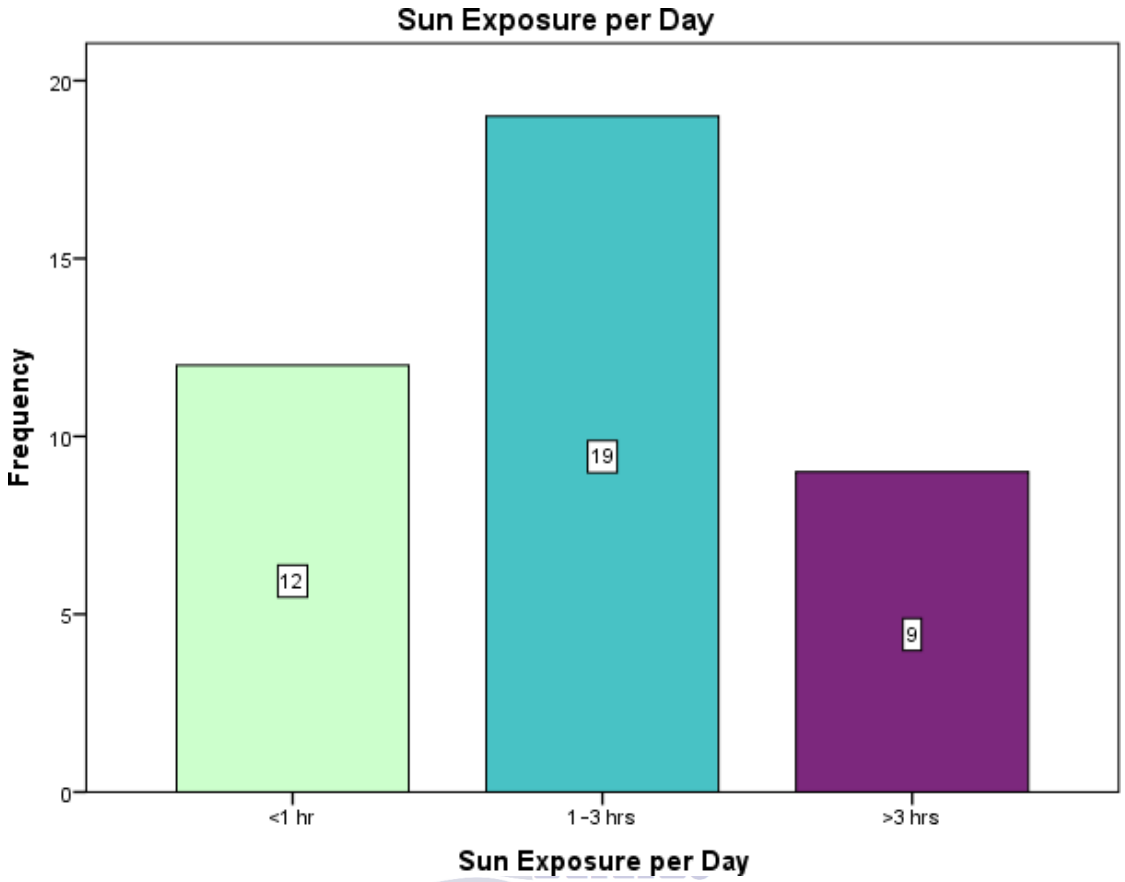

Figure 9. Bar Chart of Sun Exposure per Day.

Previous Treatment Taken		
	Frequency	Percent
Creams	12	30.0
Peels	7	17.5
Laser	7	17.5
None	14	35.0
Total	40	100.0

Table 10. Previous Treatment Taken.
This table shows the distribution of participants based on previous treatment taken for melasma (N=40). The largest group is participants who reported no previous treatment, with 14 participants (35.0%). Among those who did receive treatment, creams were most common: 12 participants (30.0%). Peels and laser were each reported by 7 participants (17.5%), respectively. Overall, the total is 40 participants (100.0%).

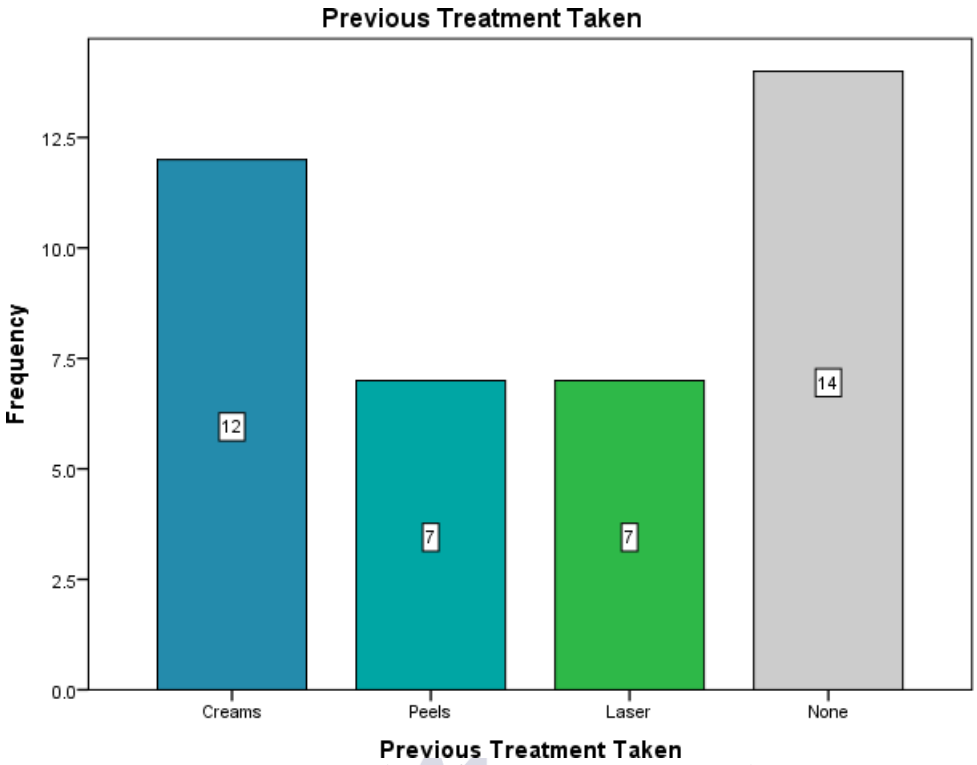

Figure 10. Bar Chart of Previous Treatment Taken.

Statistics				
	Mean	Std. Deviation	Minimum	Maximum
MASI Score (Before Treatment)	15.058	5.3122	7.5	26.4
MASI Score (After Treatment)	7.800	3.9582	2.1	18.2

Table 11. MASI Score Before and After Treatment.

This table shows the MASI Score before and after treatment. The MASI before treatment show that mean was 15.05±5.31 with Std.Deviation, the minimum score was 7.5 and maximum score was 26.4. the MASI after treatment result show that mean was 7.80±3.95 with Std.Deviation, minimum score was 2.1 and maximum score was 18.2.

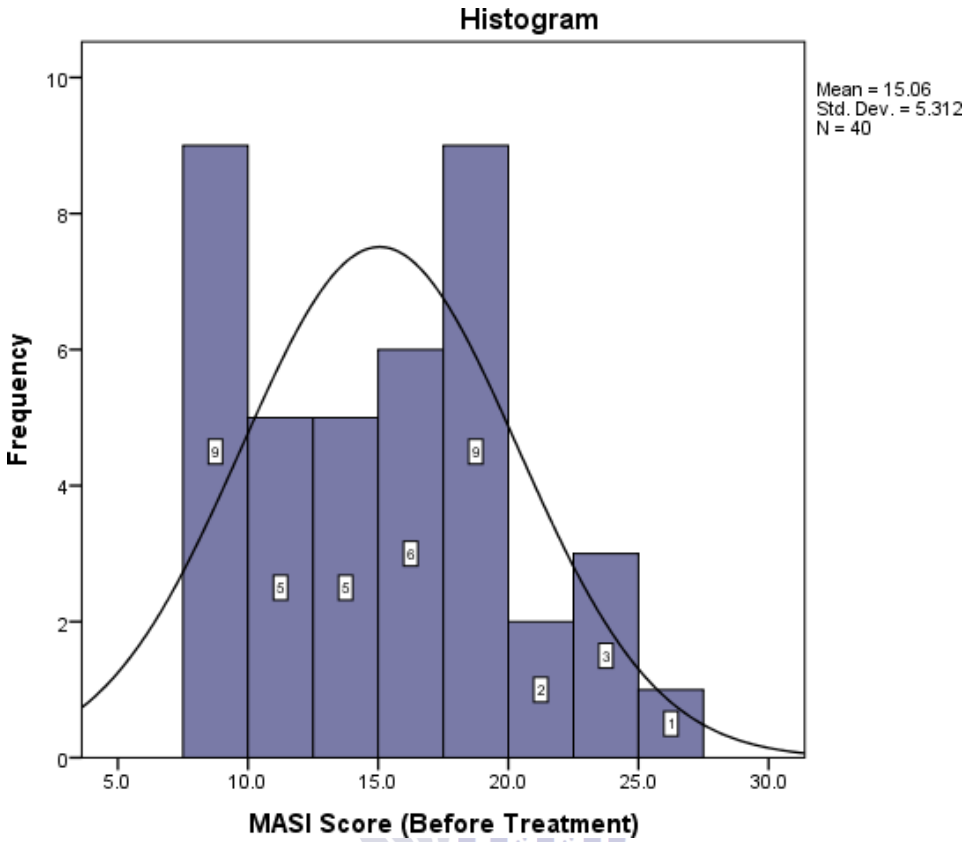

Table 11. Histogram of MASI Score Before Treatment.

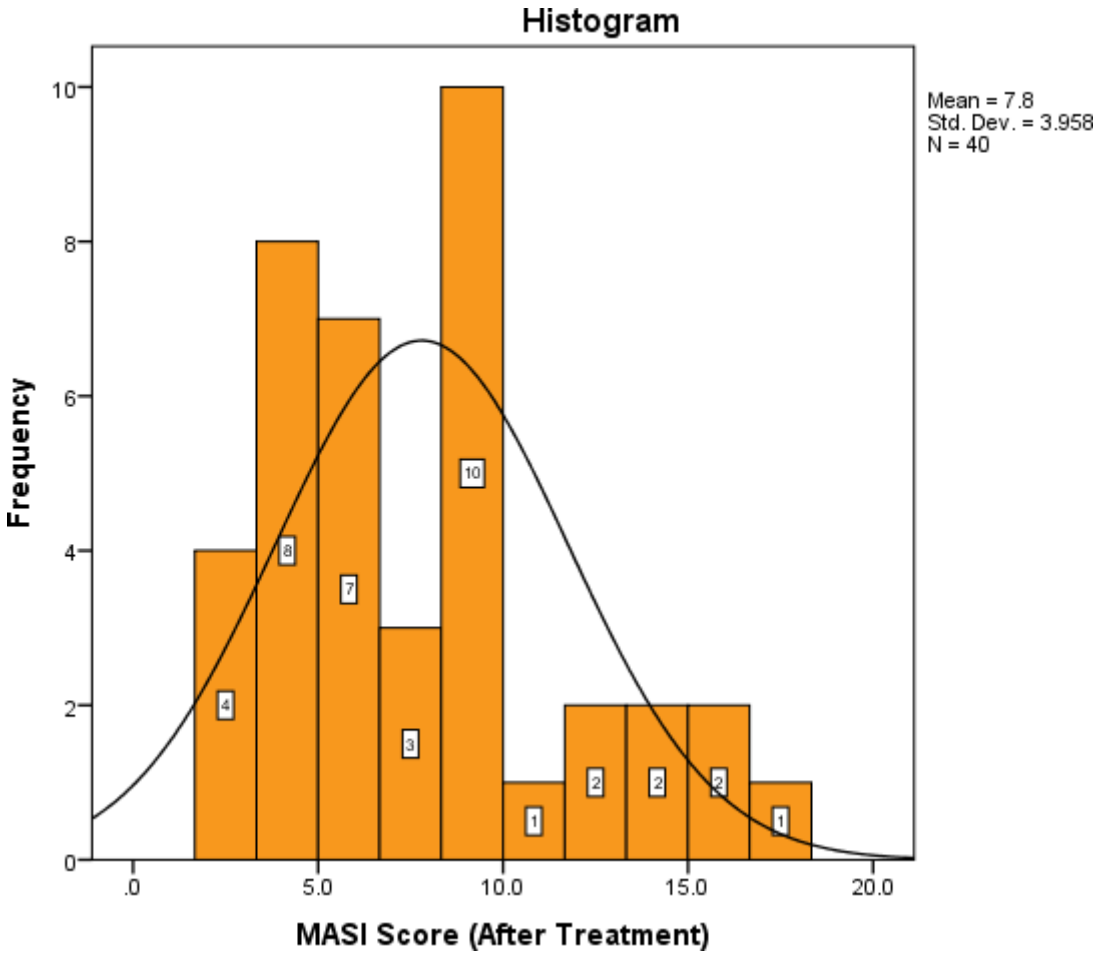

Table 12. Histogram of MASI Score Alter Treatment.

Pigmentation Improvement		
	Frequency	Percent
Marked	13	32.5
Moderate	21	52.5
Mild	6	15.0
Total	40	100.0

Table 12. Pigmentation Improvement.

The total sample size (N = 40$) is relatively small but provides a clear snapshot of efficacy. Moderate Improvement (52.5%): This is the most common result, representing over half of the group (21 participants). It indicates that the majority of subjects saw a noticeable, mid-range reduction in pigmentation. Marked Improvement (32.5%): This is the second-largest group (13 participants). "Marked" suggests a significant or very obvious clearance of pigmentation, which is a highly successful clinical result. Mild Improvement (15.0%): A small minority (6 participants) saw only slight changes. When you combine the "Marked" and "Moderate" categories, 85% of the participants experienced at least a visible, substantial improvement.

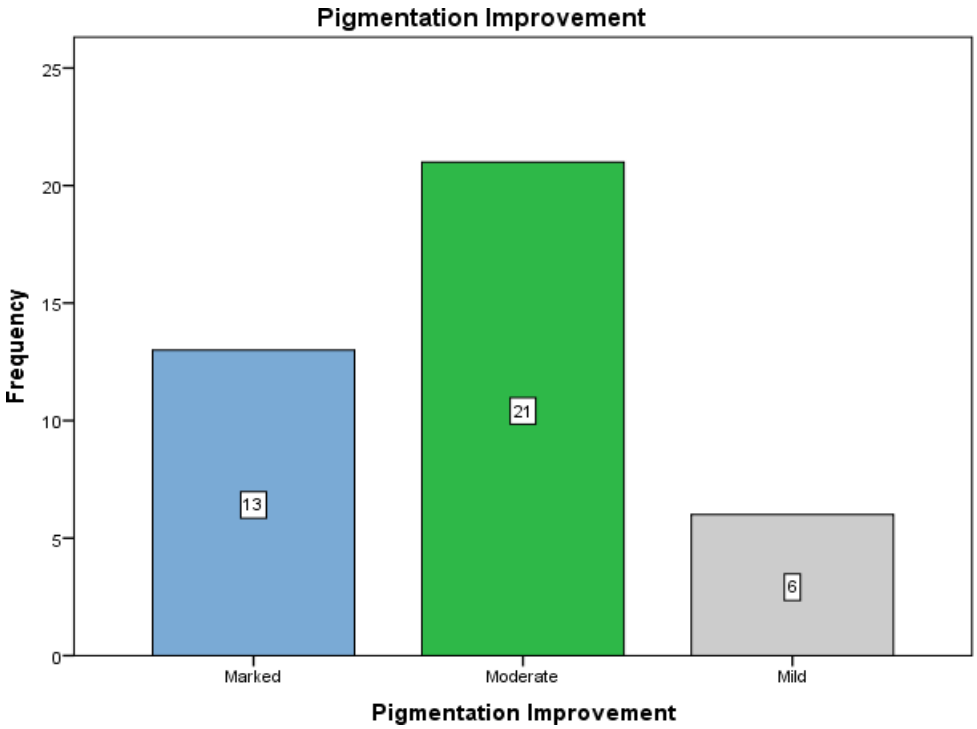

Figure 13. Bar Chart of Pigmentation Improvement.

Side Effects Observed		
	Frequency	**Percent**
Redness	14	35.0
Burning	8	20.0
Swelling	5	12.5
None	13	32.5
Total	40	100.0

Table 13. Side Effects Observed.

This table show that Redness was the most frequent observation, affecting 35% (14 participants). In clinical settings, this is often the most common superficial reaction to dermatological or topical interventions. Burning Sensation: Occurred in 20% (8 participants) of the group. Swelling was the least common side effect, reported by only 12.5% (5 participants).

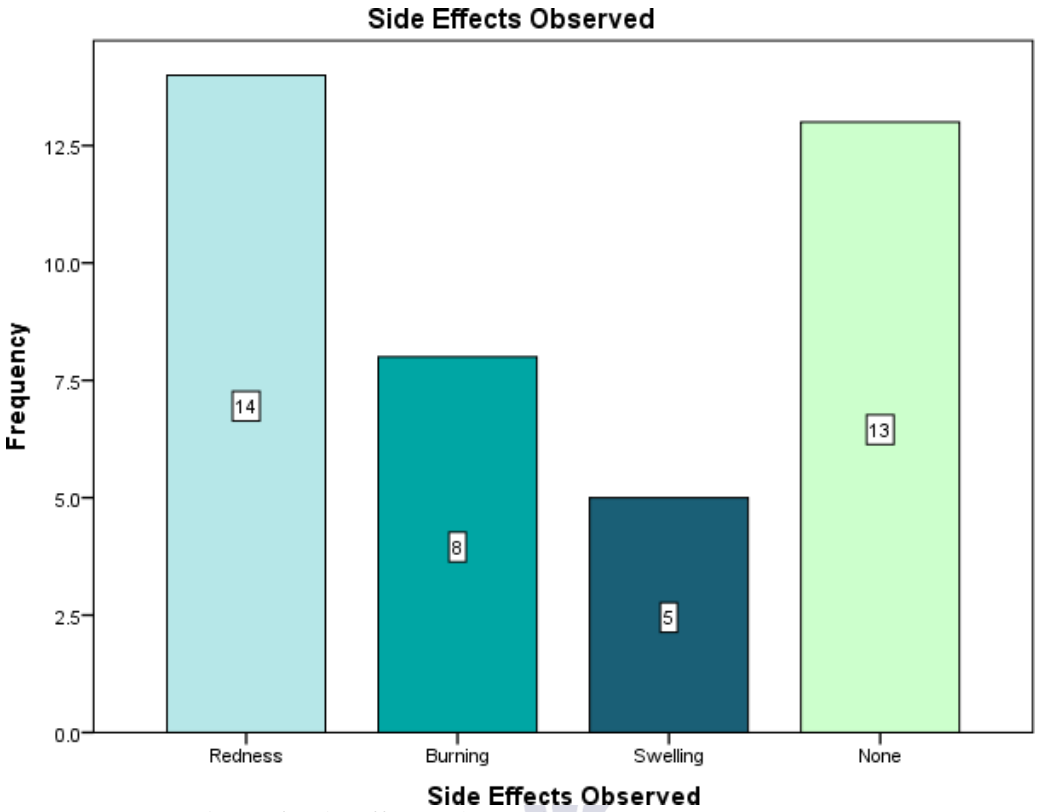

Figure 14. Bar Chart of Side Effects Observed.

Patient Satisfaction		
	Frequency	**Percent**
Very Satisfied	13	32.5
Satisfied	21	52.5
Not Satisfied	6	15.0
Total	40	100.0

Table 14. Patient Satisfaction.

This table show that Satisfied (52.5%) more than half of the participants (21 people) felt the treatment met their expectations. This represents the "standard" positive response. Very Satisfied (32.5%) nearly one-third of the group (13 people) reported the highest level of satisfaction, suggesting the results may have exceeded their expectations. Not Satisfied (15.0%) a small segment (6 people) was unhappy with the results. This figure often correlates with the "Mild Improvement" or "Side Effects" data seen in previous tables.

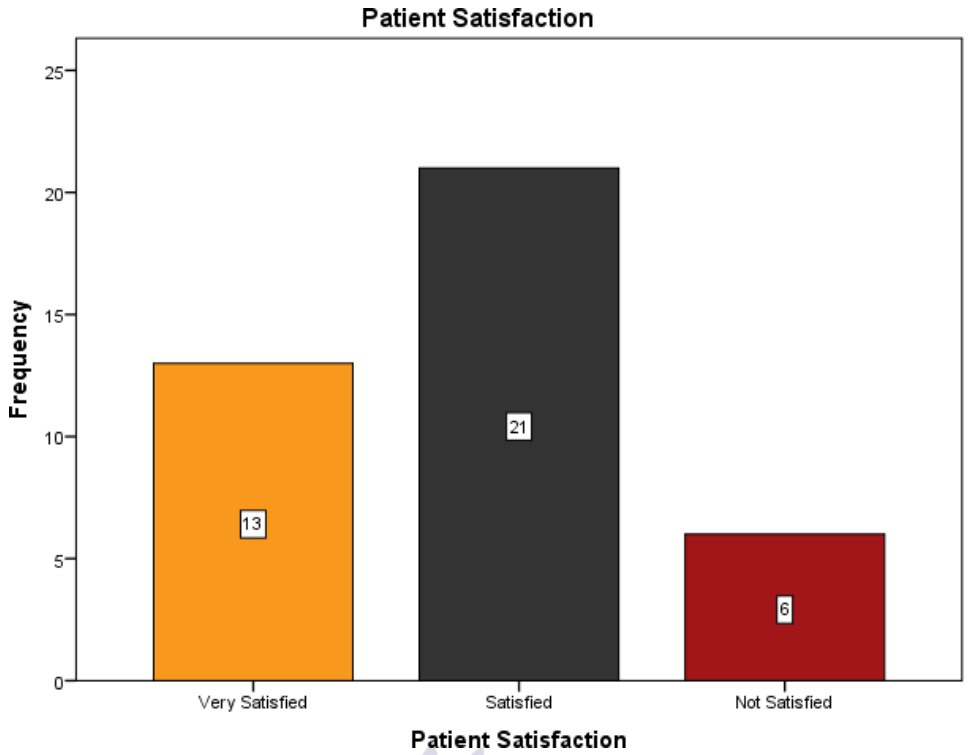

Figure 15. Bar Chart of Patient Satisfaction.

Table 15. Comparison between Group.

Group Statistics					
	Treatment Group	**N**	**Mean**	**Std. Deviation**	**p-value**
MASI Score (Before Treatment)	TXA Injection	20	15.410	5.1534	0.680
	PRP Therapy	20	14.705	5.5773	0.681
MASI Score (After Treatment)	TXA Injection	20	8.355	3.7133	0.538
	PRP Therapy	20	7.245	4.2097	0.032

The table presents the group statistics for MASI scores before and after treatment in two groups: TXA Injection and PRP Therapy, each consisting of 20 participants. Before treatment, the mean MASI score was slightly higher in the TXA Injection group (15.410 ± 5.1534) compared to the PRP Therapy group (14.705 ± 5.5773). However, the p-values (0.680 and 0.681) indicate that this difference was not statistically significant, suggesting that both groups were comparable at baseline.

After treatment, both groups showed a reduction in MASI scores, indicating improvement. The TXA Injection group had a mean score of 8.355 ± 3.7133, while the PRP Therapy group had a lower mean score of 7.245 ± 4.2097, suggesting slightly better improvement in the PRP group. The p-value for the TXA group (0.538) indicates a

non-significant change, whereas the PRP Therapy group shows a statistically significant result (p = 0.032), indicating that the reduction in MASI score after PRP treatment is significant. Overall, while both treatments improved MASI scores, PRP Therapy demonstrated a statistically significant improvement compared to TXA Injection.

DISCUSSION

This cross sectional study of 40 participants. It shows that 35.0% of participants are 20–30 years old (14 people), 42.5% are 31–40 years old (17 people), and 22.5% are 41–50 years old (9 people). Overall, the largest group is the 31–40 year age range. The result shows the distribution of participants by treatment group (N=40). There are two groups, and they are equal in size: TXA Injection includes 20 participants (50.0%) and PRP Therapy includes 20 participants (50.0%). Since both groups have the same number of participants, the treatment groups are well-balanced for comparison. Our study result shows the gender distribution of the participants (N=40). Female participants make up the majority: 34 participants (85.0%). Male participants are 6 participants (15.0%). In total, the sample includes 40 participants, with percentages adding up to 100.0%.

Our study result shows the participants' occupation type distribution (N=40). Indoor workers account for 21 participants (52.5%), while Outdoor workers account for 19 participants (47.5%). Overall, the totals add up to 40 participants (100.0%), with the largest group being indoor participants.

The mesotherapy method, which is currently widely utilized in medicine, was created in France by Pistor. Multiple intradermal or subcutaneous injections of a "mélange" of substances in tiny dosages make up this less invasive medication delivery technique. Alcohol- or oil-based compounds should not be used for mesotherapy due to the danger of cutaneous necrosis, but plant extracts, homoeopathic remedies, medications, vitamins, and other bioactive substances can be utilised.

Our study result shows the distribution of participants by skin type (N=40). The largest group is Combination skin with 14 participants (35.0%). Oily skin accounts for 11 participants (27.5%), Sensitive skin for 8 participants (20.0%), and Dry skin for 7 participants (17.5%). Altogether, the frequencies add up to 40 (100.0%).

Our study result shows the distribution of participants based on the duration of melasma (N=40). The largest group is those with melasma lasting 1–3 years, with 14 participants (35.0%). Next, 6– 12 months' accounts for 10 participants (25.0%), followed by more than 3 years with 9 participants (22.5%). The smallest group is less than 6 months, with 7 participants (17.5%). Overall, the totals add up to 40 participants (100.0%).

Polat and Sarac studied 60 melasma patients. 30 were treated with oral TA and 30 were treated by intradermal injection of PRP for 3 months. A statistically significant improvement was found in the mMASI score consistent with the literature and it was observed that the mMASI score decreased by 65.7% in the TXA group and 54.6% in the PRP group.

Our study result shows the distribution of participants by the site of melasma (N =40). The most common site is the cheeks, with 17 participants (42.5%). Full face is next, with 10 participants (25.0%). Forehead involves 9 participants (22.5%), while the upper lip has the fewest participants at 4 (10.0%). Overall, the frequencies sum to 40 (100.0%).

Our study result presents participants' family history of melasma (N=40). Most participants (23; 57.5%) reported no family history of melasma, while 17 participants (42.5%) reported yes, indicating that a substantial portion of the sample has melasma in their family. The total adds up to 40 (100.0%).

Our study result shows the distribution of participants by sun exposure per day (N=40). The largest group is those with 1–3 hours of sun exposure: 19 participants (47.5%). Less than 1 hour accounts for 12 participants (30.0%), while more than 3 hours includes 9 participants (22.5%). Overall, the totals add up to 40 participants (100.0%).

In a study by Zhang et al., who investigated the effect of platelet-rich plasma (PRP) combined with tranexamic acid (TXA) in the treatment of melasma and its effect on the serum levels of vascular endothelial growth factor (VEGF), endothelin-1 (ET-1), and melanin-stimulating hormone (MSH), they reported that PRP combined with TXA can improve the treatment outcome, maintaining normal levels of VEGF, ET-1 and MSH, and reducing the recurrence rate.

Our study result shows the distribution of participants based on previous treatment taken for melasma (N=40). The largest group is participants who reported no previous treatment, with 14 participants (35.0%). Among those who did receive treatment, creams were most common: 12 participants (30.0%). Peels and laser were each reported by 7 participants (17.5%), respectively. Overall, the total is 40 participants (100.0%).

Our study result shows the MASI Score before and after treatment. The MASI before treatment show that mean was 15.05±5.31 with Std.Deviation, the minimum score was 7.5 and maximum

score was 26.4. the MASI after treatment result show that mean was 7.80±3.95 with Std.Deviation, minimum score was 2.1 and maximum score was 18.2.

In a previous research, the mean mMASI score following treatment did not show a statistically significant difference between the two sides (2.49±1.58 in the TXA side and 2.17±1.41 in the PRP side, respectively). However, the PRP side had a greater percentage of score decrease (53.66±11.27) than the TXA side (45.67±8.10) (p=0.014).

Our study result show that total sample size (N = 40) is relatively small but provides a clear snapshot of efficacy. Moderate Improvement (52.5%): This is the most common result, representing over half of the group (21 participants). It indicates that the majority of subjects saw a noticeable, mid-range reduction in pigmentation. Marked Improvement (32.5%): This is the second-largest group (13 participants). "Marked" suggests a significant or very obvious clearance of pigmentation, which is a highly successful clinical result. Mild Improvement (15.0%): A small minority (6 participants) saw only slight changes. When you combine the "Marked" and "Moderate" categories, 85% of the participants experienced at least a visible, substantial improvement.

In the treatment of melisma, Mumtaz et al. demonstrated that intradermal PRP was much superior than intradermal tranexamic acid. At baseline, the intradermal platelet-rich plasma (PRP) group's mean mMASI score was 29.84±5.14, while the tranexamic acid group's was 29.56±4.39. There was no statistically significant difference between the two groups (p = 0.21). At four weeks, the PRP group's mMASI was considerably improved (p=0.01). In the PRP and tranexamic acid groups, the mean mMASI was 12.81±1.78 vs. 18.38±3.50, p=00,001 after 12 weeks and 8.72±3.40 vs. 14.97±4.33, p=0.02 at 24 weeks, respectively.

Our study result show that Redness was the most frequent observation, affecting 35% (14 participants). In clinical settings, this is often the most common superficial reaction to dermatological or topical interventions. Burning Sensation: Occurred in 20% (8 participants) of the group. Swelling was the least common side effect, reported by only 12.5% (5 participants).

This was in accordance with the results of Hofny et al ., who reported that the use of PRP is linked to a considerable to outstanding improvement in melasma patients, as demonstrated by the significant decline in the baseline MASI and mMASI scores, and in accordance with the levels of patients' satisfaction. Only two patients (8.7%) were unsatisfied with their improvement, whereas 39.1% of patients were very sat - isfied, 39.1% were satisfied, 13.1% were slightly satisfied, and 39.1% were satisfied overall.

Our study result show that Satisfied (52.5%) more than half of the participants (21 people) felt the treatment met their expectations. This represents the "standard" positive response. Very Satisfied (32.5%) nearly one-third of the group (13 people) reported the highest level of satisfaction, suggesting the results may have exceeded their expectations. Not Satisfied (15.0%) a small segment (6 people) was unhappy with the results.

This figure often correlates with the "Mild Improvement" or "Side Effects" data seen in previous tables.

In the study by Gamea et al., who compared the efficacy of topical tranexamic acid 5% in liposome base alone versus its combination with intradermal platelet-rich plasma (PRP) for melasma treatment, patients of the combined TXA +PRP group were more satisfied with the treatment outcome than those of the TXA group and the difference was statistically significant.

CONCLUSION

The study concludes that while PRP therapy may offer a slight edge in terms of the "glow" and speed of initial improvement, Intradermal Tranexamic Acid remains a highly accessible, cost- effective, and potent first-line injectable treatment. Often, the best clinical results are seen when these treatments are used as adjuncts to traditional topical therapies rather than as standalone replacements.

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