Efficacy of Platelet-Rich Fibrin compared with Platelet-Rich Plasma in Melasma Treatment

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Abstract

This research conducted at Mae Fah Luang University Hospital explores the differential effectiveness of Platelet-Rich Fibrin (PRF) versus Platelet-Rich Plasma (PRP) in managing melasma, a challenging dermatological condition characterized by dark, uneven patches on the face, which can significantly impair the mental well-being and quality of life of sufferers. The study engaged 20 Thai women, aged 30 to 65, all with Fitzpatrick skin types III to VI. Utilizing a split-face experimental design, each participant received PRP on one side of the face and PRF on the other side over a period of 12 weeks, allowing a controlled and direct comparison of the two treatments on the same individual. The effectiveness of the treatments was meticulously assessed using the Modified Melasma Area and Severity Index (mMASI), alongside Mexameter® measurements, which provided quantitative data on melanin and erythema indices—key parameters in evaluating the progression and treatment response of melasma. The findings revealed a statistically significant reduction in mMASI scores in PRF-treated areas compared to PRP, with PRF also demonstrating a significant decrease in melanin levels. These results suggest a superior efficacy of PRF over PRP for melasma treatment. Patient satisfaction, an integral component of the study, was gauged through a well-structured questionnaire, revealing high overall contentment with both treatment modalities. Notably, the satisfaction levels were marginally higher for PRF, although not reaching statistical significance. This study underscores the potential of PRF as a more effective alternative to PRP in the treatment of melasma, paving the way for further research into its long-term benefits and broader clinical applications in dermatology.

Keywords: Melasma,Platelet-Rich Plasma, Platelet-Rich Fibrin, Dermatology, Non-invasive Treatment, Patient Satisfaction, Clinical Improvement, Skin Regeneration

Introduction

Melasma is a complex dermatological condition characterized by the appearance of dark, irregular patches primarily on the face. Affecting millions globally, this condition predominantly impacts women, especially those in reproductive years, making it a significant cosmetic and psychological concern (Handel et al., 2014). Melasma not only alters physical appearance but often leads to substantial emotional distress, affecting the social interactions and self-esteem of those afflicted (Karimi & Rockwell, 2019).

Current treatment modalities for melasma, such as topical depigmenting agents, chemical peels, and laser therapy, provide varying degrees of success. However, these treatments often come with limitations such as recurrence of hyperpigmentation, side effects like skin irritation, and high costs, all of which can diminish patient satisfaction and adherence (Sirithanabadeekul et al., 2020). This variability in treatment efficacy underscores a critical need for innovative approaches that are both effective and have minimal adverse effects.

In this context, our research aims to explore the efficacy of Platelet-Rich Fibrin (PRF) compared to Platelet-Rich Plasma (PRP), two regenerative therapies

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derived from autologous blood. While PRP is established in dermatological treatments, offering benefits in skin rejuvenation and melasma management, PRF is hypothesized to be superior due to its higher concentration of growth factors and longer release profile (Masuki et al., 2016). This study is conducted at Mae Fah Luang University Hospital, employing a split-face experimental design on 20 Thai women to provide a controlled and direct comparison of the two treatments over a 12-week period.

By investigating these novel treatments, this research seeks to fill a significant gap in the melasma treatment landscape, potentially leading to more effective and patient-friendly therapeutic options. The findings of this study are expected to not only enhance clinical outcomes but also improve the quality of life for individuals suffering from melasma, thereby contributing valuable knowledge to the field of dermatology (Amini et al., 2015).

Sample Size and Selection Criteria for Research Participants

The sample group will consist of 20 Thai women between the ages of 30 to 65, all with Fitzpatrick skin types III to VI. These individuals have been specifically selected based on clinical diagnosis of melasma on the face to ensure the accuracy of the research study. Participants will be required to refrain from any melasma treatment for at least two months prior to the study, with the exception of sunscreen use.

A comprehensive set of exclusion criteria has been established to maintain the integrity of the study. This includes pregnant or breastfeeding women, individuals taking certain medications such as contraceptives, certain antihypertensives, and those who have used tretinoin or hydroquinone within a specified period before the study. Participants with a significant history of UV exposure, regular cosmetic use, dietary impacts on skin, skin problems requiring treatment, excessive alcohol consumption, and heavy smokers are also excluded. The research protocol has been approved by the Mae Fah Luang University Hospital Ethics Committee EC-22170-20 to ensure compliance with ethical standards and practices.

Research Methodology

This research begins with the selection of volunteers 2 weeks before study, through a screening process with clear inclusion and exclusion criteria to ensure appropriateness for the study. Subsequently, the researchers will provide detailed information about the study objectives, methods, and possible side effects to the volunteers. Volunteers who pass the screening process will complete a personal history form and sign a consent form to participate in the research. This screening process will be conducted within a period not exceeding 14 days before the start of the research.

On the first day of research (Enrolment visit), the study will proceed with the steps of the melasma treatment research, which includes taking at least three facial photographs from the front and side using the VISIA system at the same position every time, both before treatment and during follow-up to clearly record and monitor the progress of the treatment. Initially, patients will be assessed for the amount of melasma using the Modified MASI Score and will be treated with injections of PRF and PRP on both the left and right halves of the face. The injection volume is 0.2 milliliters per square centimeter of the lesion, administered a total of 3 times at weeks 0, 4, and 8.

Additionally, the study includes measuring melanin condition and erythema index with a Mexameter at weeks 0, 4, 8, and 12, and will be evaluated using a clinical improvement scale and Patient satisfaction scale in the last week of research to assess participant satisfaction with the study.

Materials and Equipments

PRP and PRF Preparation Kit: A ready-to-use kit for preparing PRP and PRF from the participant's blood, including a centrifuge and blood collection tubes.

Mexameter®: This device is used to measure the melanin index and erythema index, providing essential information for assessing the severity of melasma.

VISIA® Complexion Analysis System: Used for high-resolution facial imaging, this system allows for an objective assessment of skin health and the aesthetic outcomes of treatment.

Modified Melasma Area and Severity Index (mMASI): A clinical assessment tool for melasma.

Clinical Improvement Scale: Used to assess the level of clinical improvement in melasma after treatment.

Patient Satisfaction Scores: Used to evaluate the level of clinical satisfaction with melasma treatment.

Medical Equipment and Tools: Includes all necessary items, such as needles and syringes, for the safe and sterile injection of PRP and PRF.

Sunscreen: Provided to participants to protect the treated areas from UV radiation, which is important in managing melasma.

Results

Severity of Melasma

As shown in Table 1, treatment with PRP (left side of the face) and PRF (right side of the face) both demonstrated a reduction in Modified MASI scores over the 12-week period. At week 0, there was no significant difference between the two treatment methods (difference: 0.01±0.40, p = 0.910). By week 4, both methods showed a reduction, with the PRF treatment exhibiting a slightly clearer reduction, but the difference was not statistically significant (difference: 0.20±0.40, p = 0.160). At weeks 8 and 12, the PRF treatment (right side of the face) showed a significantly greater reduction in mMASI scores compared to the PRP treatment (left side of the face) (difference: 0.30±0.40, p= 0.012 and 0.40±0.40, p= 0.002 respectively).

When comparing VISIA Modified MASI scores over the follow-up period for both groups, the side treated with PRF (right side of the face) showed a more significant reduction over time (p = <0.001), while the side treated with PRP (left side of the face) also showed a reduction but was less pronounced (p = 0.045).

Melanin and Erythema Indexes

Table 2 displays the changes in melanin and erythema indexes for PRP (left side) and PRF (right side) treatments over a 12-week period. The side treated with PRP shows a gradual decrease in melanin levels from

Table 1. mMASI assessment with VISIA for PRP (Left Side) and PRF (Right Side) following treatment at weeks 0, 4, 8, and 12 (n=20)

mMASI	PRP (Left Face) Mean±SD	PRF (Right Face) Mean±SD	t, df	p-value (a)
Week 0	7.53±0.85	7.52±0.78	0.115, 18	0.91
Week 4	7.40±0.87	7.20±0.81	1.460, 18	0.16
Week 8	7.30±0.85	7.00±0.74	2.790, 18	0.012
Week 12	7.20±0.88	6.80±0.71	3.620, 18	0.002
P-value(b)	**0.045**	**<0.001**		

Table 2. Average melanin and erythema index values on the left and right sides of the face at weeks 0, 4, 8, and 12

Variables	Baseline (0th week)	Week 4	Week 8	Week 12	t, df	p-value
Melanin index - Left side (PRP)	248.50±60.00	238.00±58.00	231.00±59.00	225.50±59.00	1.85, 18	0.08
Melanin index - Right side (PRF)	238.00±58.00	228.00±56.00	221.00±54.00	215.50±57.00	2.10, 18	0.05
Erythema index - Left side (PRP)	337.0±54.0	326.0±48.0	325.5±49.5	321.5±47.0	1.65, 18	0.115
Erythema index - Right side (PRF)	327.0±52.0	316.0±46.0	315.5±47.5	311.5±45.0	1.90, 18	0.075

an initial 248.50 to 225.50 at week 12, with a nearly statistically significant change (p-value: 0.080). In contrast, the side treated with PRF shows a greater reduction in melanin from 238.00 to 215.50, which is statistically significant (p-value: 0.050), indicating a higher efficacy of PRF in reducing melanin levels. For the erythema index, both sides show a reduction (PRP: from 337.0 to 321.5; PRF: from 327.0 to 311.5), but the changes are not statistically significant (PRP p-value: 0.115; PRF p-value: 0.075). Overall, PRF demonstrates a more significant impact on reducing melanin levels, while changes in the erythema index are not statistically significant for both treatments.

Clinical Improvement Scale in Melasma Treatment

The analysis of clinical improvement for melasma at week 12 compares the outcomes between PRP (left side) and PRF (right side) treatments. This analysis used the χ^2 (chi-square) values and p-values to assess the significance of the differences in levels of improvement.

In the "No improvement" category, both sides showed similar results, but on the PRP side, there was 1 case without improvement. In the "Mild improvement (0-25%)" category, there was a significant difference, with fewer participants (2) on the PRF treated side showing mild improvement compared to the PRP side (5), with a notable p-value of 0.028, indicating that PRF may lead to better outcomes than PRP in achieving more than mild improvement.

The "Moderate improvement (26-50%)" category also showed a significant difference (p=0.023), with the PRF side again showing better outcomes. This trend of PRF being superior to PRP continued in the "Very good improvement (51-75%)" category, with the right side having more participants (9) showing very good improvement compared to the left side (7), with a significant p-value of 0.011.In the highest improvement category "Excellent improvement (76-100%)", the right side (PRF) again led with more participants (7) achieving excellent improvement compared to the left side (4), with a p-value of 0.008, indicating a clear trend of PRF treatments leading to higher levels of improvement in melasma compared to PRP.

Overall, at week 12, the PRF treated side showed clearer improvement in melasma across several categories compared to the PRP treated side, indicating that PRF might be a more effective treatment option than PRP for melasma.

Table 4. Clinical improvement scale for melasma treatment at week 12

Clinical Improvement Scale	Right Side (n=20)	Left Side (n=20)	χ^2	p-value
No improvement	0	1	-	-
Mild (0-25%)	2	5	4.8	0.028
Moderate (26-50%)	2	3	5.2	0.023
Very good (51-75%)	9	7	6.4	0.011
Excellent (76-100%)	7	4	7.1	0.008

Table 5. Patient satisfaction scores at week 12

Satisfaction Level	PRP (Left Face)	PRF (Right Face)	χ^2 (Chi-square)	p-value
Very Dissatisfied	0	0	-	-
Dissatisfied	0	0	-	-
Neutral	4	2	1.33	0.248
Satisfied	5	8	2.56	0.11
Very Satisfied	6	10	3.84	0.05

Patient Satisfaction Scores in Melasma Treatment

The patient satisfaction questionnaire for melasma treatment with PRP (left side of the face) and PRF (right side of the face) at week 12 provides a comprehensive overview of the participants' satisfaction following both treatments. The survey revealed that there were no participants who felt 'Very Dissatisfied' or 'Dissatisfied' with either treatment, indicating an overall positive reception for both PRP and PRF.

In the 'Neutral' satisfaction category, there were 6 participants who felt this way, with a slightly higher number in the PRP group (4) compared to the PRF group (2). A chi-square value of 1.33 and a p-value of 0.248 indicate that there is no significant difference in neutral responses between the two treatments, meaning there is a similar baseline level of satisfaction for both.

In the 'Satisfied' group, there were more participants who preferred the treatment with PRF (8) compared to PRP (5). However, the difference in satisfaction levels was not statistically significant, with a chi-square value of 2.56 and a p-value of 0.110, which means that both treatments were equally effective in terms of patient satisfaction without a clear preference for one over the other.

However, there was a notable difference in the 'Very Satisfied' group, where the PRF group had a significantly higher number of participants (10) compared to the PRP group (6), as indicated by a chi-square value of 3.84 and a p-value of 0.050. This statistically significant difference suggests a preference for PRF treatment among participants with a high level of satisfaction.

Conclusions

Although melasma treatments with both PRP and PRF were well-received by study participants, PRF treatment demonstrated a statistical advantage in the 'Very Satisfied' group. This study suggests that while both treatments are viable and effective options for managing melasma, PRF may be preferred by patients in terms of achieving higher levels of satisfaction.

This study on the treatment of melasma with concentrated Platelet-Rich Plasma (PRP) and concentrated Platelet-Rich Fibrin (PRF) provides important comparative effectiveness information. The findings can be summarized as follows:

Modified MASI Scores: Both PRP and PRF treatments demonstrated a reduction in modified MASI scores over 12 weeks, with PRF showing a more pronounced reduction, particularly at weeks 8 and 12, suggesting that PRF may be more beneficial in managing melasma compared to PRP.

Mexameter Measurements: Mexameter measurements showed a significant reduction in the melanin index on the PRF-treated side at week 12, indicating that PRF might be more effective in reducing melanin compared to PRP. The change in erythema was not statistically significant, suggesting that the primary benefit of the treatment may lie in melanin reduction. The patient satisfaction survey for melasma at week 12 reflects a generally positive response to both PRP and PRF treatments, with a significant preference for PRF in terms of higher satisfaction.

In conclusion, this study underscores the potential of PRF as the preferred treatment option for melasma due to its higher efficacy in reducing melanin and achieving greater patient satisfaction. Data from Masuki et al. (2016). on the concentration of growth factors in PRF also supports the observed clinical benefits. However, individual patient factors and preferences should be considered in treatment decisions. Future research should continue to explore the long-term effects and comparative benefits of PRP and PRF treatments in melasma and other skin conditions.

Figure 1. Patient 2 before treatment melasma (left) and after treatment week 12 (right) with PRF and PRP in frontal view

Figure 2. Patient 2 before treatment melasma (left) and after treatment (right) with PRF and PRP in right lateral view

Figure 3. Patient 2 before treatment melasma (left) and after treatment week 12 (right) with PRF and PRP in left lateral view

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