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Effect of the Combination of Autologous Platelet-Rich Plasma and Nano-fat Application on the Donor Site of Split-Thickness Graft on Scar Appearance

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Abstract:

Introduction: Nano fat grafting is the procedure of converting adipose tissue into liquid fat and obtaining adipose stem cells and stromal vascular fraction cells. Platelet-rich plasma (PRP) stimulates growth factors and starts signaling pathways that promote tissue repair and regeneration. The primary objective of this research was to assess the effectiveness of combining autologous PRP with Nano-fat grafting application on the donor site of split-thickness grafts.

Methods: This is a prospective interventional study, including 30 patients of both genders undergoing medium split-thickness skin grafting. The resultant area at the donor site was used as the test area. It was divided into equal halves; one was covered by our combination autologous PRP and Nano-fat (1:1) solution (part A), while the other half was covered by Vaseline gauze (part B).

Results: The mean age among examined patients was 36.03 ± 17.11 years. Part A had significantly shorter healing time compared to part B. Part A had significantly lower incidences of infection and itching when compared to part B. While no significant difference was reported between parts A and B regarding incidences of pain or hypertrophic scar.

Conclusion: The application of a combination of autologous platelet-rich plasma and Nano-fat on the donor site of a split-thickness graft shortened the time needed for epithelialization and healing, lowered the occurrence of infection at the donor site of STSG, decreased the symptoms associated with the scar, and slightly improved the quality of the scar.

Keywords: Platelet-rich plasma; Nano fat; Donor site of split thickness graft.

1. Introduction

Based on thickness, skin grafts are divided into two types: split thickness and full thickness. Split-thickness grafts are additionally classified into three categories: thick (0.45-0.6 mm), intermediate (0.3-0.45 mm), and thin (0.15-0.3 mm). Full-thickness grafts typically exceed 0.6 mm in thickness and are also known as Wolfe-Krause grafts [1].

For full-thickness skin grafts, the donor site wound undergoes primary healing through suturing. In contrast, split-thickness skin graft donor site wounds heal via re-epithelialization. Epithelial cells proliferate across the wound bed from the underlying remnants of the dermis. Donor site wounds often heal in two separate phases over a period of 7–10 days. The first is the wet phase, where an absorbent dressing is necessary due to the wound's high exudative capacity. The second stage is called the dry phase, during which the amount of exudate decreases and the wound bed becomes dry. To avoid disturbing the fragile wound bed at this stage, apply a non-adherent dressing that can remain in position [2].

Vascular endothelial cells are a scientifically verified medium for tissue regeneration, and adipose tissue is considered the safest and most immune-protective. It is made up of pre-adipocytes, adipose stem cells (ASCs), big lipid-laden adipocytes, and a variety of stromal vascular cells, including fibroblasts [3-5].

Nano-fat grafting is the procedure of converting adipose tissue into liquid fat and obtaining adipose stem cells and stromal vascular fraction cells [6].

Adipose-derived stem cells are thought to have antioxidant characteristics that protect against damage caused by hypoxia, reactive oxygen species (ROS), and ischemia-reperfusion. They can also stimulate angiogenesis, reduce inflammation, produce lymphangiogenic factors, and attract systemic endogenous stem cells [7].

Autologous platelet-rich plasma (PRP), extracted through centrifugation from the blood of the patient, comprises various growth factors including interleukin 1 (IL-1), transforming growth factor (TGF), vascular endothelial growth factor (VEGF), epidermal growth factor (EGF), insulin-like growth factor (IGF-1), and platelet-derived growth factor (PDGF) [8, 9].

The precise mechanisms of action of PRP remain unknown; PRP's stimulation of

growth factors starts signaling pathways that promote tissue repair and regeneration [10].

The synergistic effects of combining these modalities specifically on the donor sites of split-thickness grafts remain relatively unexplored.

This research was intended to analyze the effectiveness of combining autologous PRP with Nano-fat grafting application on the donor site of split-thickness grafts, with a focus on assessing the extent of wound healing, tissue regeneration, scar appearance (vascularity, pigmentation, pliability, surface appearance, pain, itching), complications, and patient and physician satisfaction.

2. Subjects & Methods

2.1. Subjects

This is a prospective interventional study of the influence of a combination of autologous PRP and Nano-fat application on donor sites of split-thickness grafts on scar appearance, including 30 patients of both genders undergoing medium split-thickness skin grafts for different etiologies, such as trauma, burn, or coverage of the site of lesions excision, at the period from April 2024 to March 2025 at the Plastic Surgery Department in Fayoum University Hospital, and the cases were followed up for at least 6 months.

All patients gave their written and fully informed consent before undergoing surgery, and our study was permitted by the principles of the Research Ethics Committee of the Faculty of Medicine, Fayoum University.

Inclusion criteria

- Patients undergoing medium split-thickness skin graft procedures for various indications, such as burns, traumatic injuries, or surgical defects.
- Ability to give knowledgeable and voluntary consent to take part in the research.
- Availability for long-term follow-up assessments to monitor wound healing and outcomes.

Exclusion criteria

- Presence of significant comorbidities or conditions that may affect wound healing or compromise study outcomes.
- Patients with uncontrolled diabetes mellitus, bleeding tendency, or on anticoagulant therapy.
- Patients younger than ten years old.
- Presence of any contraindications to harvesting Nano-fat grafts or PRP, such as bleeding disorders or active infections.

2.2. *Study design*

This is a prospective interventional study in which 30 patients who underwent medium split-thickness skin graft (STSG) for different etiologies at the Department of Plastic Surgery in Fayoum University Hospital were included. In all patients, the donor site of the STSG was divided into equal parts:

- Part A: was covered by a combination of autologous PRP and Nano-fat (1:1) solution, which was topically applied and covered with Vaseline gauze.
- Part B: was covered by Vaseline gauze only.

2.3.Methods

Preoperative preparation

* History taking: detailed history taking, including any comorbidity, previous operations, especially graft operations, and history of the lesion and its cause.
* Clinical examination: good clinical examination of the defect, the lesions that were excised, possible graft donor sites, and possible fat donor sites.
* Preoperative labs: complete blood count, liver functions, kidney functions, albumin, and coagulation profile.
* Imaging: X-ray or ultrasonography, or MRI if needed.

Operative Procedure

Patients were placed in supine, prone, or lateral position as needed according to the site of defect, under general or spinal anesthesia.

All included patients had the following:

A. Autologous Platelet-rich plasma preparation

Collecting about 20 milliliters of the blood of patient. After collection, the blood tubes were positioned in a centrifuge machine using a double centrifugation process **(Figure 1).**

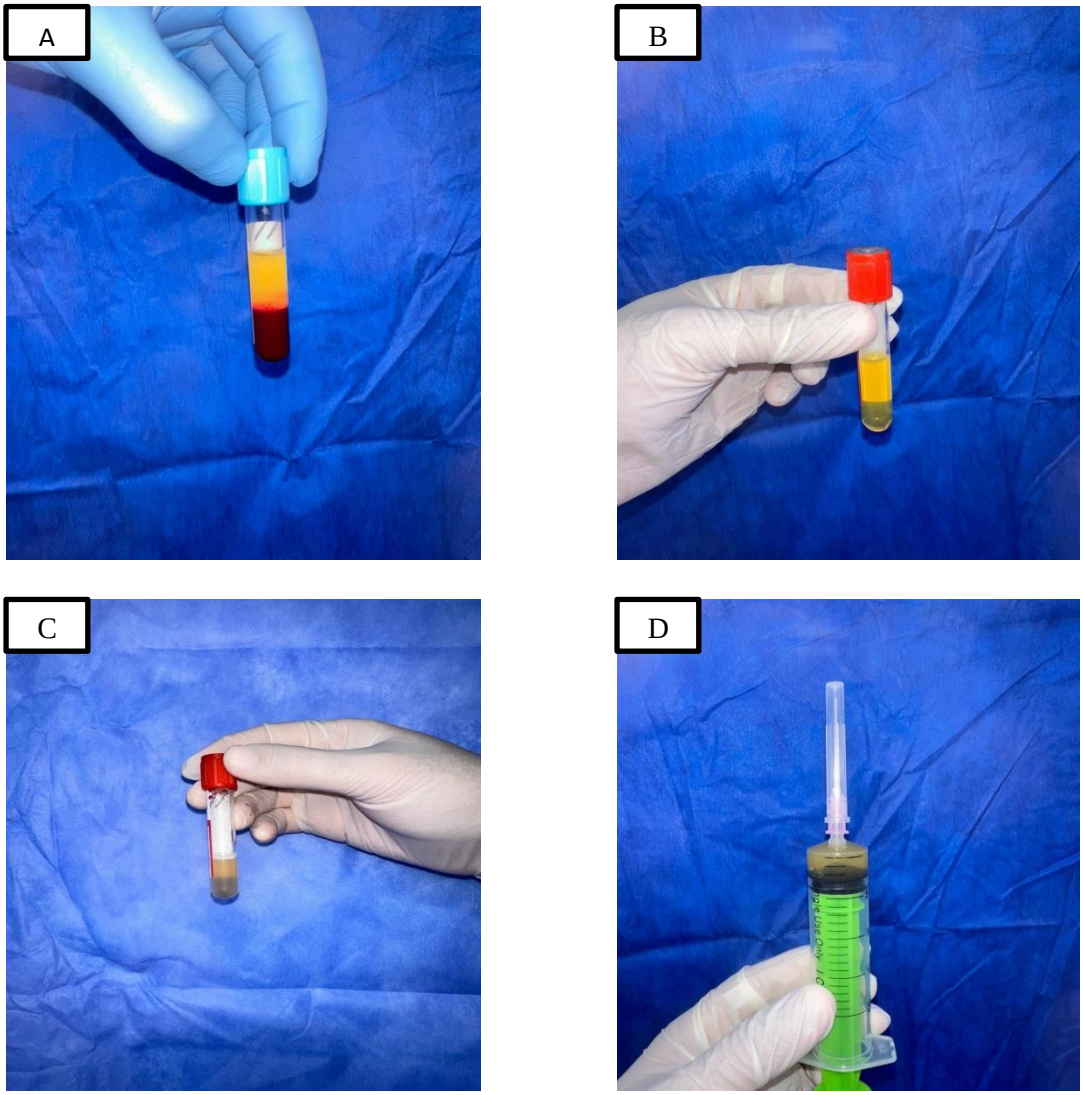

Figure 1: PRP preparation. A) The blood sample after the first centrifugation and the upper 2/3 containing platelets will be aspirated and injected into a second tube. B) After the second centrifugation and the resultant lower 1/2 containing PRP will be aspirated and injected into another tube. C) PRP after adequate stirring to dissolve the platelets well in the plasma. D) PRP after aspiration into a sterile syringe.

First centrifugation

Centrifugation at speed 1000 rpm for 10 minutes, leaving the lower 1/3 containing white and red cells and the upper 2/3 containing platelets, was aspired and injected into a second tube.

Second centrifugation

Centrifugation at 4000 rpm for 15 minutes, the upper 1/2 of the supernatant plasma was removed, and the resultant lower 1/2 containing PRP was adequately stirred to dissolve the platelets well in the plasma and aspirated into sterile syringes.

***B. Nano-fat graft preparation*:**

Infiltration

To introduce the tumescent solution into the donor sites for fatty tissue extraction, a number 11 blade was utilized to create a small incision of approximately 2 mm at the donor site, through which a blunt multi-hole infiltration cannula was inserted. The injection combination was made by mixing 1000 milliliters of regular saline solution with 1 cc of adrenaline (1 mg/ml). For the epinephrine to fully act and create adequate hemostasis, we then had to wait for ten to fifteen minutes for the tumescent solution to enter the tissue **(Figure 2).**

Fat harvesting

Donor sites, such as the lower belly and thighs, were selected based on the amount of adipose tissue. Using the same incision used for the mixture infiltration, a 3 mm blunt-tipped harvesting cannula with several 1 mm side holes will be utilized to collect the fat via a 10 or 20 cc Luer-Lock syringe.

Fat processing (refinement)

The fat tissue aspirated was transferred mechanically 30 times through Luer-to-Luer connectors of 2.4 mm, 1.4 mm, and 1.2 mm, leading to disaggregated emulsion. This mechanically de-conjugated fat was passed through the Nano Transfer device filter, producing 0.6- to 0.4-mm fragments, resulting in Nano-fat as a product.

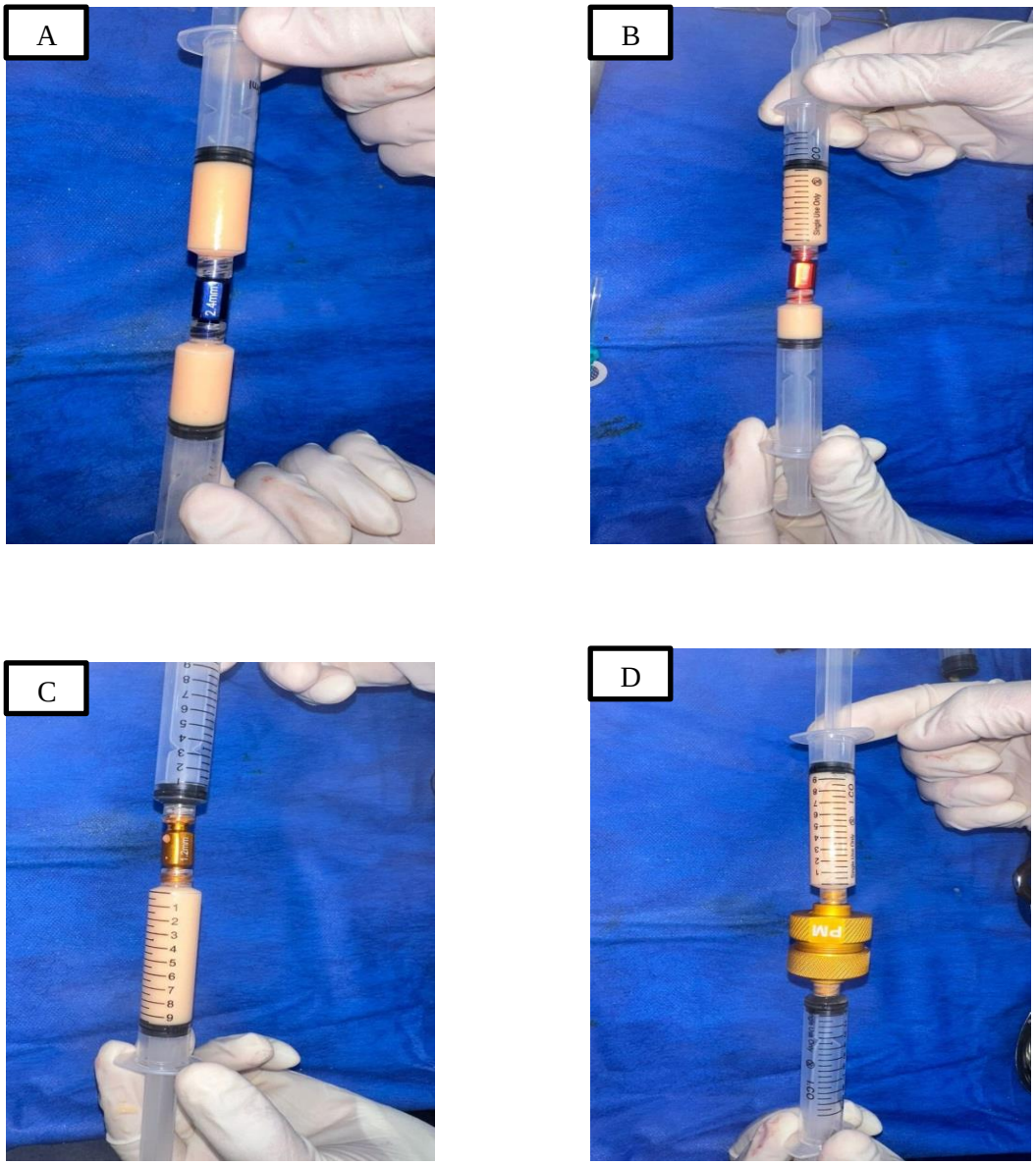

Figure 2: Nano-fat preparation. A) The fat tissue aspirated was transferred mechanically 30 times through a Luer-to-Luer connector of 2.4 mm. B) The fat tissue aspirated was transferred mechanically 30 times through a Luer-to-Luer connector of 1.4 mm. C) The fat tissue aspirated was transferred mechanically 30 times through a Luer-to-Luer connector of 1.2 mm. D) The mechanically de-conjugated fat was passed through the Nano Transfer device filter, resulting in Nano-fat as a product.

C. Preparation of a combination of autologous Platelet-rich plasma and Nano-fat in a ratio of 1:1

D. Harvesting split-thickness skin graft (STSG)

One sheet of medium STSG was taken using a freehand manual dermatome. The resultant area at the donor site was used as the test area. It was divided into equal halves; one was covered by our combination autologous PRP and Nano-fat (1:1) solution, topically applied and covered with Vaseline gauze (was labeled **A),** while the other half was covered by Vaseline gauze only (was labeled **B**). Closure of the donor site by bandage was done, followed by fixation of STSG in the recipient area and bandage application.

Postoperative follow-up

Initially, patients were followed up daily for any donor or graft site discharge or odor, and then removal of the tie over was done after 5 to 7 days, then follow-up of the donor and graft site every 48 hours, and then after the discharge of the patient, follow-up on weekly outpatient clinic visits for a minimum of six months.

Postoperative evaluation and assessment

Parts A and B of the patients were monitored and compared in terms of time of healing, scar appearance, including vascularity, pigmentation, pliability, and surface appearance according to the modified Vancouver scar scale; complications, including infection, pain, itching, and hypertrophic scar; and patients' and physicians' satisfaction.

2.4.Statistical methods

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 28. Data was summarized using mean and standard deviation for quantitative variables and frequencies. For comparing categorical data, Chi chi-square ($\chi 2$) test was performed. *P*-values less than 0.05 were considered statistically significant**.**

3. Results

In the current study, 30 patients who underwent medium split-thickness skin graft (STSG) for different etiologies at the Department of Plastic Surgery in Fayoum University Hospital were included. In all patients, the donor site of the STSG was divided into equal parts:

- **Part A:** was covered by a combination of autologous PRP and Nano-fat (1:1) solution, which was topically applied and covered with Vaseline gauze.
- **Part B:** was covered by Vaseline gauze only **(Figures 3-6).**

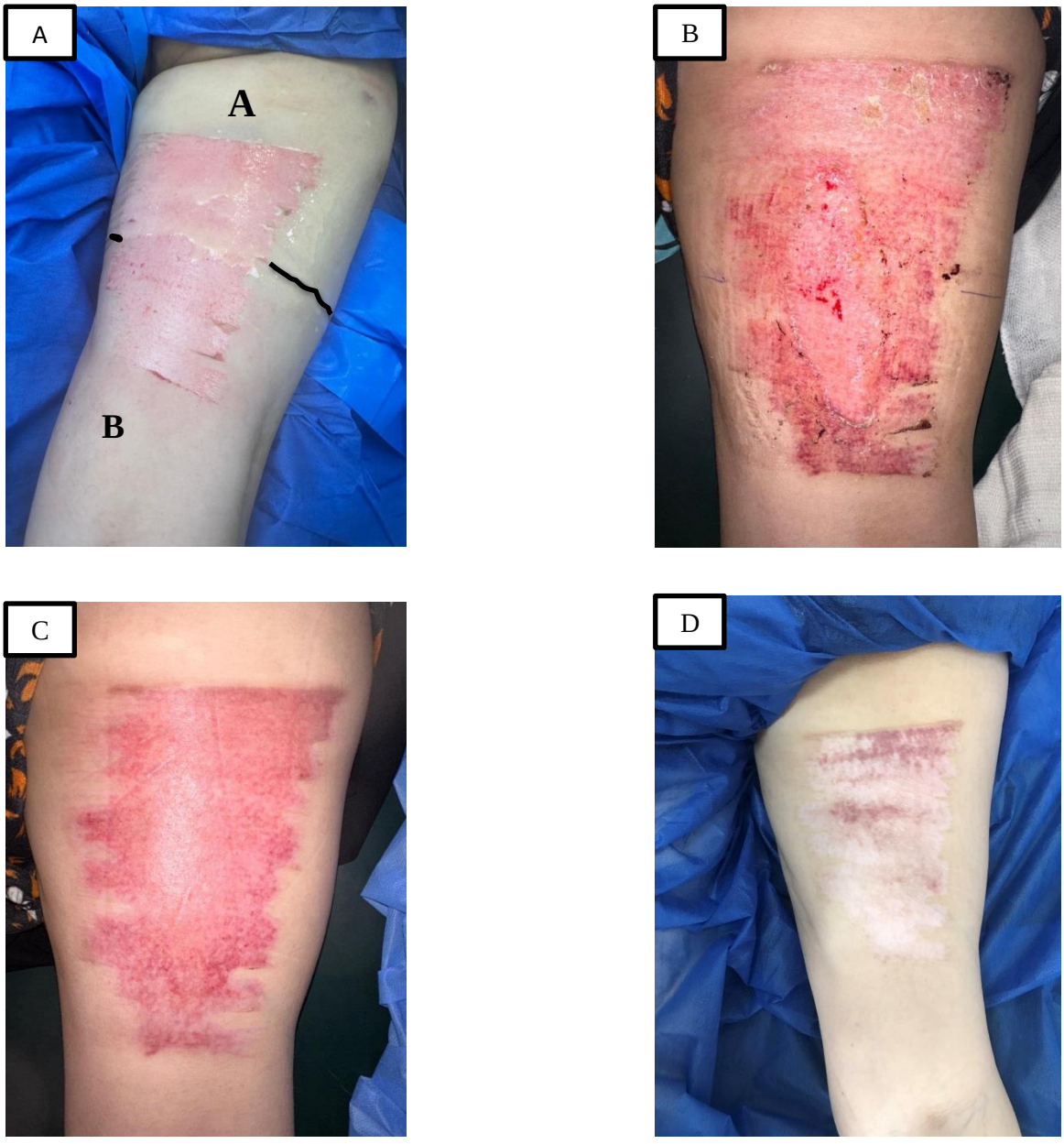

Figure 3: A) Intraoperative photo of the split-thickness graft donor site after application of a combination of Nano-fat and PRP. B) Postoperative photo after 2 weeks. C) Photo taken two months after surgery. D) Photo taken six months after surgery.

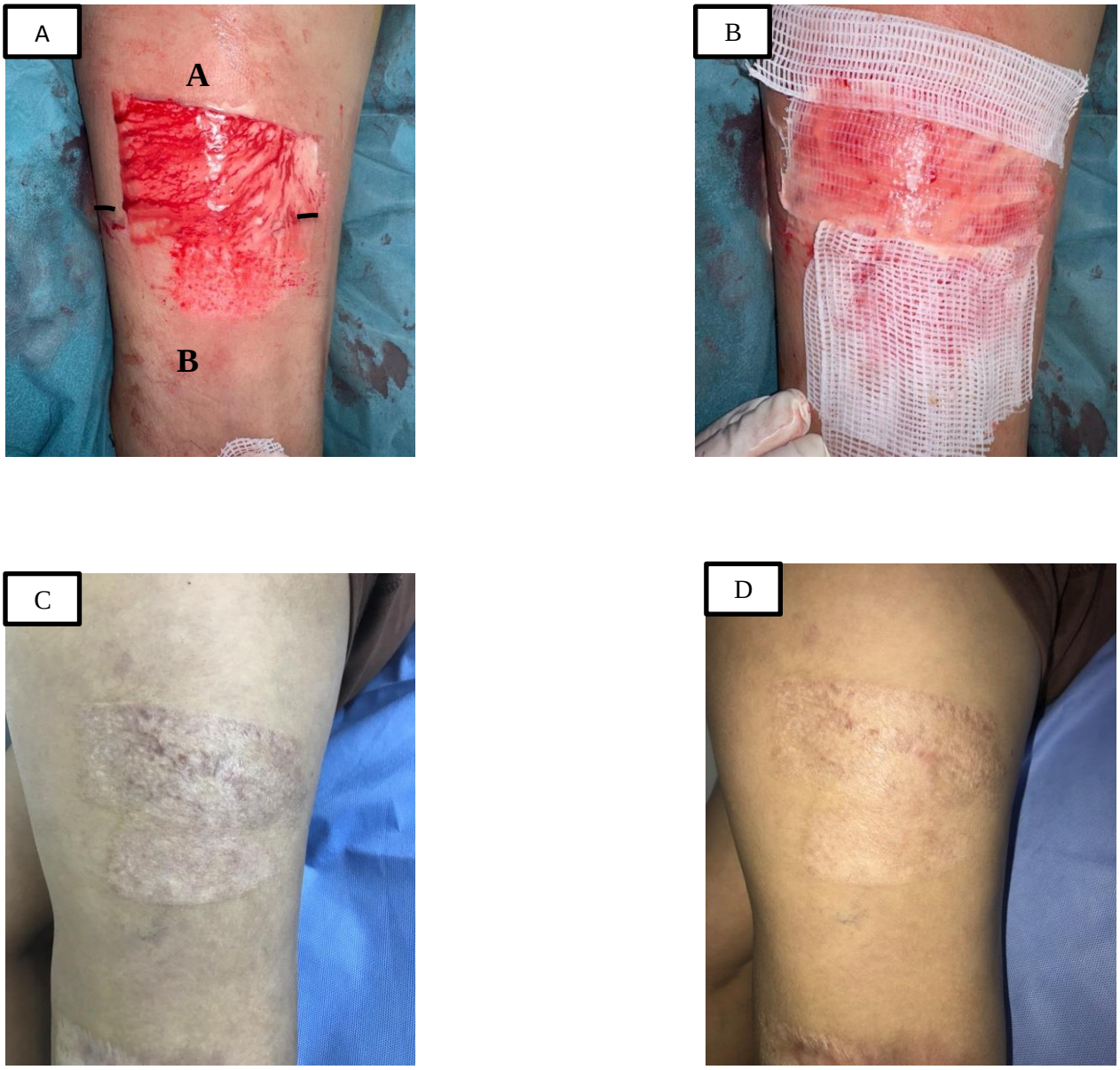

Figure 4: A) Intraoperative photo of the split-thickness graft donor site after application of a combination of Nano-fat and PRP. B) Intraoperative photo after application of 2 separate Vaseline gauzes over the donor site of split thickness graft after application of a combination of Nano-fat and PRP. C) Photo taken four months after surgery. D) Photo taken eight months after surgery.

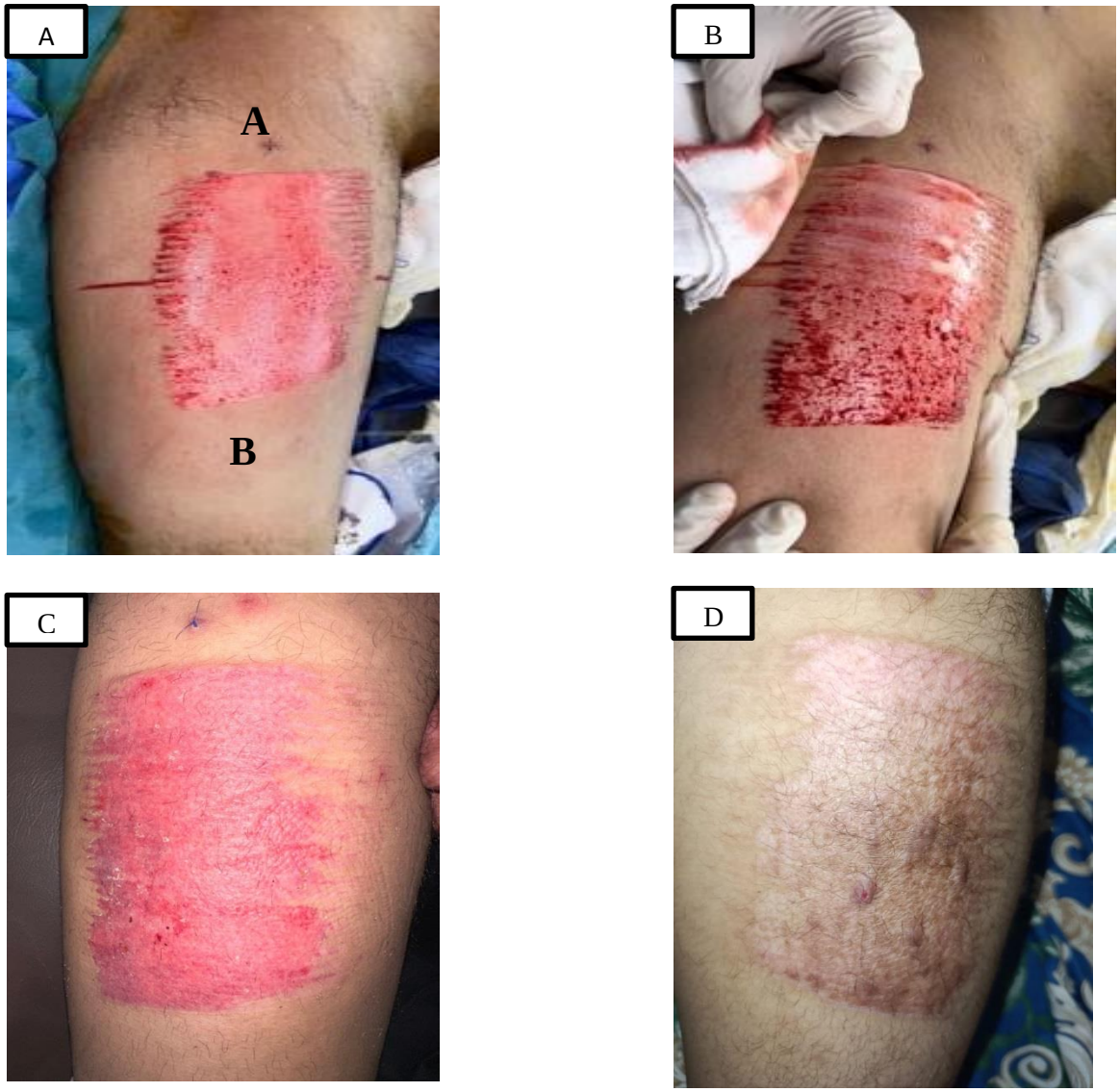

Figure 5: A) Intraoperative photo of the split-thickness graft donor site. B) Intraoperative photo of the split-thickness graft donor site after application of a combination of Nano-fat and PRP. C) Photo taken three months after surgery. D) Photo taken six months after surgery.

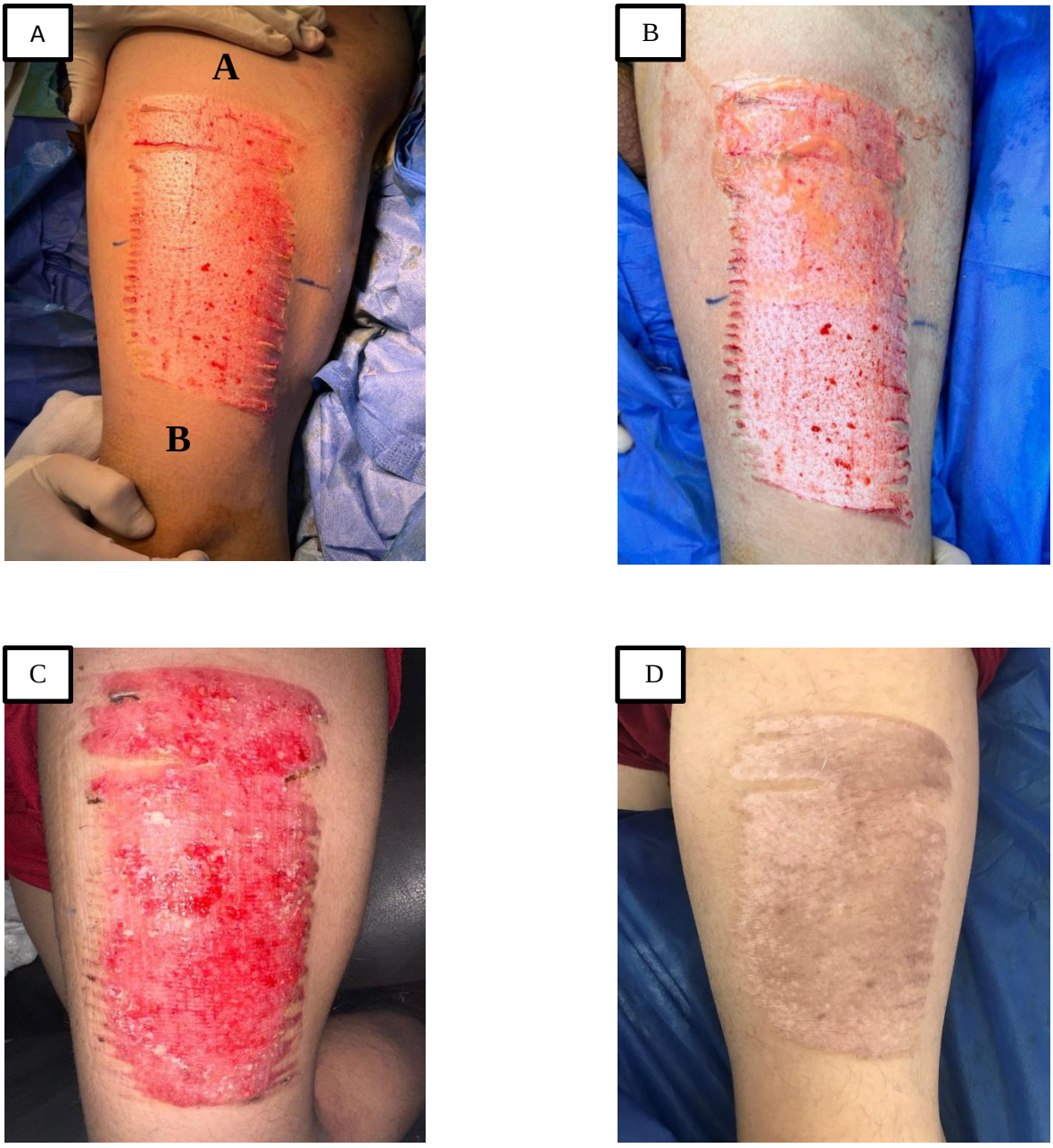

Figure 6: A) Intraoperative photo of the split-thickness graft donor site. B) Intraoperative photo of the split-thickness graft donor site after application of a combination of Nano-fat and PRP. C) Photo taken two months after surgery. D) Photo taken six months after surgery.

Among the studied patients, 11 (36.7%) were females and 19 (63.3%) were males. The mean age among the studied patients was 36.03 ±17.11 years, spanning 13 to 80 years. Mean BMI among examined

patients was 25.98 ±2.77 kg/m², ranging between 21.70 and 31.40 kg/m² **(Table 1)**.

Table 1: Anthropometric and demographic data of examined patients.

Variables		Frequency
Gender	Male	19(63.3%)
	Female	11(36.7%)
Age (years)	Mean ±SD	36.03 ±17.11
	Range	13.00-80.00
BMI (kg/m^2)	Mean ±SD	25.98 ±2.77
	Range	21.70-31.40

SD: Standard Deviation, BMI: Body Mass Index.

Trauma was the most commonly reported cause of the defects in 15 (50.0%) patients, followed by excision of lesions that required coverage with STSG, which was reported in 8 (26.7%) patients, and burns, which were reported in 4 (13.3%) patients. While diabetic foot, coverage of the donor site of the reversed sural flap, and animal bite were each reported in 1 (3.3%) patient.

Regarding the site of the defect, the left leg was the most commonly reported site of defect in 6 (20.0%) patients, followed by the right foot, which was reported in 5 (16.7%) patients, and the face and left forearm, each of which was reported in 3 (10.0%) patients. Right forearm, right leg, left thigh, and left foot each were reported in 2 (6.7%) patients. While the neck, right elbow, left arm, left hand, and left axilla were each reported in 1 (3.3%) patient. Mean size of defect was 67.87 ± 71.98 cm², ranging between 12 and 375 cm² (**Table 2).**

Table 2: Descriptive data of the defect in studied patients.

	Variables	Count (%)
Etiology of defect	Trauma	15(50.0%)
	Burn	4(13.3%)
	Excision of lesions	8(26.7%)
	Diabetic foot	1(3.3%)
	Coverage of the donor site of the reversed sural flap	1(3.3%)
	Animal bite	1(3.3%)
Site of defect	Face	3(10.0%)
	Neck	1(3.3%)
	Right elbow	1(3.3%)

	Left arm	1(3.3%)
	Left forearm	3(10.0%)
	Right forearm	2(6.7%)
	Left hand	1(3.3%)
	Left axilla	1(3.3%)
	Left thigh	2(6.7%)
	Right leg	2(6.7%)
	Left leg	6(20.0%)
	Left foot	2(6.7%)
	Right foot	5(16.7%)
Size of defect (cm^2)	Mean ±SD	67.87 ±71.98
	Range	12.00-375.00

The site of the skin graft donor site was from the left thigh in 11 (36.7%) patients and from the right thigh in 19 (63.3%) patients. The site of the fat graft donor site was from the right thigh in 11 (36.7%) patients, from the left thigh in 6 (20.0%) patients, and from the abdomen in 13 (43.3%) patients. Mean size of skin graft donor site was 132.17 ± 80.07 cm², ranging between 54 and 450 cm². Mean platelet count in blood was 301.00 ± 62.28*10^3, ranging between 180 and 412 103. Mean platelet count in the PRP was 733.33 ± 185.99*10^3, ranging between 440 and 1140×10^3 (**Table 3).**

Table 3: Descriptive data of the grafts in studied patients.

Variables			**Mean ±SD**
Site of graft donor site	Skin graft	Left thigh	11(36.7%)
		Right thigh	19(63.3%)
	Fat graft	Left thigh	6 (20.0%)
		Right thigh	11(36.7%)
		Abdomen	13(43.3%)
Size of skin graft donor site (cm2)		Mean ±SD	132.17 ± 80.07
		Range	54.00- 450.00
Platelet count (*103)	In CBC	Mean ±SD	301.00 ± 62.28
		Range	180.00- 412.00
	In PRP	Mean ±SD	733.33 ± 185.99
		Range	440.00- 1140.00

SD: Standard Deviation, CBC: complete blood picture, PRP: platelet-rich plasma

Part A had significantly shorter healing time compared to part B (17.43 ±2.85 vs. 19.80 ±5.63 days; *P* =0.046) (**Table 4).** There was no significant distinction between part A and part B regarding postoperative assessment, including the vascularity, pigmentation, and surface appearance. Regarding pliability score, part A was much better than part B, but it was statistically insignificant (*P* > 0.05) **(Table 5).**

Table 4: Comparison between part A and part B regarding healing time.

	Part A	**Part B**	**P value**
	Mean ±SD	**Mean ±SD**	
Time of healing (days)	17.43±2.85	19.80±5.63	**0.046***

SD: standard deviation. Statistical significance was attributed to P-values below 0.05

Table 5: Comparison between part A and part B regarding postoperative scar assessment and evaluation (according to the modified Vancouver scar scale).

Variables			**Part A**		**Part B**		***P*-value**
			Count	**%**	**Count**	**%**	
Postoperative assessment and evaluation	Vascularity	Normal	0	0%	0	0%	1
		Pink	25	83.3%	25	83.3%	
		Red	5	16.7%	5	16.7%	
		Purple	0	0%	0	0%	
	Pigmentation	Normal	0	0%	0	0%	0.949
		Hypopigmentation	7	23.3%	6	20.0%	
		Mixed pigmentation	18	60.0%	19	63.3%	
		Hyperpigmentation	5	16.7%	5	16.7%	
	Pliability	Normal	0	0%	0	0%	0.352
		Supple (flexible with minimal resistance)	23	76.7%	19	63.3%	
		Yielding (moderate resistance)	2	6.7%	6	20.0%	
		Firm (inflexible, resistant to manual pressure)	5	16.7%	5	16.7%	
	Surface appearance	Similar to normal	0	0.0%	1	3.3%	1
		Slight mismatch	20	66.7%	19	63.3%	
		Moderately rougher	10	33.3%	10	33.3%	

P-values less than 0.05 were considered statistically significant

Part A had significantly fewer incidences of infection (0.0% vs. 30.0%; *P* =0.002) and itching (*P* =0.003) when relative to part B. While no significant difference was reported between part A and part B regarding incidences of pain or hypertrophic scar (**Table 6).**

Table 6: Comparison between part A and part B regarding postoperative complications.

Variables			Part A		Part B		P-value
			Count	%	Count	%	
Complications	Infection	Yes	0	0.0%	9	30.0%	**0.002***
		No	30	100.0%	21	70.0%	
	Itching	No itching	25	83.3%	16	53.3%	**0.003***
		Sometimes itchy (50% of time)	0	0.0%	9	30.0%	
		Frequently itchy (70 % of time)	5	16.7%	5	16.7%	
	Pain	No pain	25	83.3%	21	70.0%	0.222
		Sometimes painful (50% of time)	5	16.7%	9	30.0%	
		Frequently itchy (70 % of time)	0	0%	0	0%	
	Hypertrophic scar	Yes	5	16.7%	5	16.7%	1
		No	25	83.3%	25	83.3%	

Statistical significance was attributed to P-values below 0.05

Part A had a significantly higher prevalence of good patient satisfaction when compared to part B (73.3% vs. 46.7%; *P* =0.023). Whereas no significant difference was documented between part A and part B regarding physician satisfaction (**Table 7).**

Table 7: Comparison between part A and part B regarding patient satisfaction and physician satisfaction.

Variables		Part A		Part B		P value
		Count	%	Count	%	
Patient satisfaction	Excellent	3	10.0%	4	13.3%	**0.023***
	Good	22	73.3%	14	46.7%	
	Fair	0	0.0%	7	23.3%	
	Poor	5	16.7%	5	16.7%	
Physician satisfaction	Excellent	2	6.7%	5	16.7%	0.084
	Good	23	76.7%	16	53.3%	
	Fair	0	0.0%	4	13.3%	
	Poor	5	16.7%	5	16.7%	

Statistical significance was attributed to P-values below 0.05.

4. Discussion

One popular method for reconstructing skin defects is split-thickness skin grafting (SSG). The development of a secondary wound site and the accompanying morbidities, such as scarring and pain, are an inevitable disadvantage of the operation. Infection can also postpone patient recovery and make donor site healing even more difficult. To reduce discomfort and re-epithelialization timeframes, it is crucial to improve wound healing conditions [11].

In 2013, Tonnard and colleagues were the pioneers of Nano-fat. The procedure of mechanically turning micro-fat, which is extracted from subcutaneous fat and holds a significant quantity of adipose tissue-derived stem cells (ADSCs) along with stromal vascular fraction (SVF) cells, into a liquid form is referred to as "Nano-fat." These cells aid in wound healing and improve skin texture by encouraging the creation of novel blood vessels and releasing growth factors that assist in minimizing fibrosis and inflammation [12].

An autologous blood product called platelet-rich plasma (PRP) is made from a component of the plasma fraction that is left over after whole blood is centrifuged. It is distinguished by a platelet concentration that is greater than typical physiological values [13].

In the 1970s, hematologists first used the expression platelet-rich plasma (PRP); the term was used to describe plasma with a platelet count elevated than that of peripheral blood that was utilized as a transfusion product for thrombocytopenic patients [14].

From that time onward, it has been used in a variety of specialties, such as ophthalmology, urology, plastic surgery, pediatric surgery, gynecology, and cardiac surgery. Transforming growth factor-β (TGF-β) and Platelet-derived growth factor (PDGF) are substances found in the α-granules of platelets that enhance cell division and proliferation to support tissue regeneration [15].

PRP has also been shown to encourage epithelialization at donor sites for split-thickness skin grafts [16].

Autologous PRP has recently been thought to be a very efficient way to increase fat intake, and numerous studies have already shown that employing PRP in fat grafting improves fat grafting survival

and wound healing in reconstructive and cosmetic surgeries [17].

In 2016, Barone et al. assessed the efficiency of PRP and Nano-fat in treating 15 patients with atrophic scars from acne, finding that the scar's height had improved [18].

In 2014, Gentile et al. compared fat graft with PRP in 10 patients with fat graft alone in 10 patients with facial burn and post-traumatic scarring. After a year, they found that 69% of the volume and contour restoration were maintained with fat and PRP compared to fat injection alone, indicating that PRP increased the fat graft's survival rate [19].

Tenna et al. in 2017 employed autologous fat grafts with PRP to treat atrophic acne scars in 15 patients, demonstrating that Nano-fat plus PRP injections can fill scars and enhance lesion height [20, 21].

Modarressi in 2013 suggests that incorporating PRP into fat preparation could be a dependable method of delivering the right nutrients at the early stages of transplantation, improving fat survival and increasing the predictability of the outcome because PRP releases growth factors that promote cell differentiation, angiogenesis, and proliferation [22]

So, in our study, we decided to use the combination of autologous PRS and Nano-fat, as many studies supported this idea to get the benefits of both regarding their effects on the scar appearance of the split-thickness graft donor site, as described above.

Following reviewing the literature, we did not find any research that studied the effect of this combination on the scar appearance of the donor site of the split-thickness graft, but there are some studies that described the effect of either Nano-fat or PRP on the donor site of split-thickness graft healing.

El Sherbeny et al. (2023) described the effect of Nano-fat graft on the healing of donor site of the split-thickness graft donor site, and they concluded that Nano-fat has been shown to accelerate epithelialization in split-thickness skin graft donor sites, shorten wound healing time, enhance epithelium thickness, and improve vascularity and pliability in terms of healing quality [23].

This was consistent with our research., as part A, which was covered by a combination of autologous PRP and Nano-fat, had significantly shorter healing time compared to part B, which was covered by Vaseline gauze only (17.43 ±2.85 vs. 19.80

±5.63 days), and regarding pliability score, part A was much better than part B but was statistically insignificant, and there was no significant distinction reported among part A and part B concerning the vascularity score.

In 2021, García-Sánchez JM et al. reported that using PRP to treat the donor site of STSG in burn patients reduced the duration to epithelialization while improving scar quality and pain management [24]. This was consistent with our research regarding the time of epithelialization, but in our study, there was no significant distinction reported between part A and part B regarding incidences of pain. In 2021, Rakesh Kumar Jain et al. revealed that adding PRP topically to STSG donor site accelerates the early phase of wound healing, facilitating less pain and faster healing, lowering patients' misery linked to STSG donor site [25]. In 2020, Slaninka et al. established that PRP had an advantageous influence on skin graft donor sites, reducing healing time [26]. These were consistent with our research regarding the time of healing, but in our study, there was no significant distinction reported between part A and part B regarding incidences of pain.

In our study, Part A, which was covered by a combination of autologous PRP and Nano-fat, had a significantly shorter healing time compared to Part B, which was covered by Vaseline gauze only. Part A had significantly lower incidences of infection and itching when compared to part B. While no significant distinction was reported between part A and part B regarding incidences of pain or hypertrophic scar. There was no significant distinction between part A and part B regarding postoperative assessment, including the vascularity, pigmentation, and surface appearance. Regarding pliability score, part A was much better than part B, but it was statistically insignificant.

5. Conclusion

The application of a combination of autologous platelet-rich plasma and Nano-fat on the donor site of a split-thickness graft shortened the time needed for epithelialization and healing, lowered the occurrence of infection at the donor site of STSG, decreased the symptoms associated with the scar, mainly the itching, and slightly improved the quality of the scar, especially the pliability, but still statistically

insignificant. It had no significant difference regarding the vascularity, pigmentation, and surface appearance of the scar. The limitation of this study is the lack of long-term follow-up, so further extensive research is needed to precisely evaluate the long-term effects of combining autologous platelet-rich plasma with Nano-fat application on the split-thickness graft donor site in relation to scar evaluation, especially pigmentation scores, and these findings should be validated by histopathological correlation with clinical results.

Conflict of interest: The researchers confirm the absence of any conflicts of interest.

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Ethical approval: Ethical approval by the Ethics Committee of the Faculty of Medicine, Fayoum University, on March 17, 2024, number (M 708).

Patient consent: The patients gave their informed consent for the utilization and publication of their images.

AI declaration: Not applicable

Authors' contributions:

WA: Conceptualization, Methodology, Writing, Review, Visualization, and Editing. **AHE**: Review, Validation, Supervision, Conceptualization, and Methodology. **AHG:** Software, Investigation, and Writing—Original Draft. **SM:** Methodology, Writing, Review, Editing, and Supervision.

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