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Comparative Outcomes of Fat Grafting With and Without Platelet-Rich Plasma: A Single-Center Retrospective Study with Sub group Analysis

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Abstract

Background: Autologous fat grafting is widely used in reconstructive and aesthetic surgery, but variability in graft retention and complication rates remains a challenge. Platelet-rich plasma (PRP), rich in growth factors and cytokines, may enhance graft survival and improve clinical outcomes.

Methods: A retrospective analysis of 128 patients (193 procedures) who underwent fat grafting with (n=120) or without (n=73) PRP augmentation between 2019 and 2025. PRP was added at a 9:1 or 8:2 fat-to-PRP ratio depending on the graft site. Outcomes assessed included subjective contour improvement, patient satisfaction, complications, and repeat grafting, with statistical significance set at $p<0.05$.

Results: Baseline demographics were largely comparable; however, the PRP group had significantly higher mean BMI (29.48 vs. 26.80, p=0.005), lower diabetes prevalence (p<0.001), fewer former smokers (p=0.001), more aesthetic indications (p=0.004), and less prior chemotherapy (p=0.01). Contour improvement scores were significantly higher in the PRP group at both 1 month (p=0.03) and 6 month follow-up (p=0.003). Patient satisfaction was also significantly higher at 1 month (p=0.04). The PRP group demonstrated lower rates of fat necrosis (4.2% vs. 13.7%, p=0.01) and dermatitis (9.2% vs. 22.4%, p=0.02). Repeat grafting rates were not statistically different (p=0.11), though BMI was an independent predictor for needing multiple sessions (p=0.04). Fat necrosis and wound dehiscence were significantly associated with repeat grafting (p=0.01, p=0.0022 respectively). Subgroup analyses in burn, oncologic, and radiation cohorts demonstrated consistently higher 6 month patient satisfaction in the PRP group, reaching statistical significance in the oncologic (p=0.02) and burn (p=0.03) subgroups.

Conclusion: The baseline imbalances represent potential confounders and are acknowledged as limitations of the non-randomized design. PRP augmentation in fat grafting is associated with improved contour outcomes, early patient satisfaction, and reduced complications such as fat necrosis and dermatitis. Subgroup analyses support the benefit of PRP across burn, oncologic, and radiation-damaged tissue contexts, particularly in long-term satisfaction While repeat procedures were similar between groups, BMI emerged as a predictor. These findings suggest that PRP may play a critical role in enhancing fat graft viability, particularly in aesthetic and reconstructive cases. Further prospective studies are needed to optimize PRP concentration, delivery, and long-term efficacy.

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Keywords: Autologous Fat Grafting; Platelet-Rich Plasma; Fat Graft Survival; Fat Necrosis; Burn Reconstruction, Oncologic Reconstruction; Radiation-Damaged Tissue; Emulsified Fat.

Introduction

Reconstructive and aesthetic surgery have become an increasingly vital part of modern healthcare, driven by rising cancer survival, increasing trauma cases, and a growing demand for procedures that improve quality of life [1,2]. The latest ISAPS Global Aesthetic Report 2024 highlights a significant rise in the demand for aesthetic procedures worldwide. The International Society of Aesthetic Plastic Surgery estimates that close to 38 million procedures were performed in 2024, including 17.4 million surgical and 20.5 million non-surgical treatments. This marks an overall increase of about 42.5 percent over the past four years, reflecting a steady upward trend in aesthetic care utilization [3]. Autologous fat grafting has gained widespread acceptance in both reconstructive and aesthetic practice because it is biocompatible, readily available, and capable of producing natural looking results [4]. It is commonly used in breast reconstruction, facial rejuvenation, and correction of contour deformities following injury or surgery [5,6]. However, one of its main limitations is the variability in graft survival. Studies report resorption rates ranging from 20% to 80%, which can result in partial loss of volume and the need for repeat procedures [7-9]. This unpredictability can affect both clinical outcomes and patient satisfaction, particularly in more complex cases. The survival of the graft largely depends on how quickly it establishes a blood supply and integrates with the surrounding tissue. This process can be particularly challenging in areas with poor vascularity, such as scarred, burned, or irradiated tissues [10]. In these situations, reduced blood flow and altered tissue structure can lead to complications such as fat necrosis, fibrosis, and uneven contour, ultimately compromising the final outcome [11]. Therefore, the treatment should be laid on the basis of improving graft retention and minimizing complications. In recent years, increasing attention has been given to adjunctive approaches that may improve fat graft survival. One such option is platelet rich plasma, which is obtained from the patient's own blood and is rich in growth factors which contains a high concentration of growth factors, has been proposed as one such option [12]. It promotes new blood vessel formation, support tissue healing, and reduce inflammation, thereby improving graft viability [13]. Although platelet-rich plasma (PRP) is increasingly utilized in clinical practice, evidence regarding its efficacy remains inconsistent. Variations in preparation protocols, PRP concentrations, and outcome measures across studies complicate definitive conclusions [14,15]. Additionally, there is a lack of comparative studies that evaluate outcomes of fat grafting with and without platelet rich plasma within the same clinical setting. Evidence is especially limited for key groups such as patients with burns, cancer-related defects, or radiation damage, where improving blood flow may be particularly helpful. Patient-centered outcomes, like satisfaction and the need for repeat procedures, have not been consistently evaluated. In this light of information, the present study was conducted to compare the outcomes of autologous fat grafting performed with and without platelet rich plasma in a single center retrospective cohort. The study focused on contour improvement, patient satisfaction, complications, and the need for repeat grafting, with additional subgroup analyses across key clinical conditions. Through this approach, the study aims to provide practical acumens into the role of platelet rich plasma in improving outcomes in both reconstructive and aesthetic surgery.

Methods and Materials

A retrospective chart review was conducted of patients who underwent autologous fat grafting with or without PRP augmentation between January 2019 and March 2025 at the University of Alabama at Birmingham by a single surgeon. The study received approval from the Institutional Review Board, and written informed consent was obtained from all patients for both the procedure and the use of their data for research purposes. A total of 128 patients who underwent 193 fat grafting procedures were included in the analysis. Patients were assigned to either PRP-enhanced fat grafting (PRP group, n=120 procedures) or standard fat grafting (non-PRP group, n=73 procedures) based on surgeon recommendation and patient preference, rather than randomization. Patient charts were reviewed for demographic data, comorbidities, surgical indications, procedural details, and postoperative outcomes. The indications for fat grafting were categorized as: keloid scar, hypertrophic scar, burn scar, aesthetic-face, breast post-mastectomy reconstruction, aesthetic-breast, aesthetic-buttock, and face oncoplastic reconstruction. Autologous platelet concentrate isolation used to be a laborious procedure that required costly equipment and expert personnel in order to separate and prepare the materials for use in surgery. The introduction of kits and reasonably priced equipment has made it simple and safe to do PRP perioperative isolation at outpatient and inpatient bases utilizing an automated dual-spin procedure (APEX biologix, Harvest Technologies, Inc, Plymouth, Mass).

PRP Preparation Protocol

Based on the APEX Biologix system, PRP was prepared using the XC-PRP-60 cycle (PRP 60, Spin: 10 Minutes, 3500 rpm/2300 rcf). Approximately 20-30ml of venous blood was drawn from each patient in the PRP group and processed in the centrifuge immediately before fat grafting. After the first spin, the plasma layer was separated and underwent a second centrifugation to concentrate the platelets. The

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final PRP preparation yielded 3-4ml of PRP with a platelet concentration of 4-6 times baseline.

Autologous Fat Harvest technique

Adipose tissue was harvested from donor sites, typically the abdomen or inner thighs, using either 60-mL Toomey syringes or a closed power-assisted liposuction system. A 3.0 or 3.7-mm blunt-tip cannula was used following infiltration with tumescent solution. The tumescent solution was composed of 1 liter of lactated Ringer's solution, 25 mL of 1% lidocaine without epinephrine, and 1 mg of epinephrine. Up to 35 mg/kg was infiltrated to minimize pain and reduce bleeding. Harvested fat was strained and washed with saline before being transferred between syringes 15-20 times for emulsification. In patients with low fat volume, adipose tissue was directly placed in syringes, decanted vertically, and the fluid fraction discarded before emulsification. Filtration was not routinely performed, except when injecting superficially (e.g., perioral lines or scars), in which case emulsified fat was passed through a sterile strainer to remove fibrous material.

Injection was customized by region

Face: 0.9-mm blunt cannula; Breast: 0.9-mm cannula (periareolar) and Tuohy needle (quadrants); Buttocks: 3.7-mm cannula under ultrasound guidance; subcutaneous only, avoiding gluteus maximus; Superficial dermis (e.g., scars): 25G needle with filtered fat. When PRP was used, it was mixed at a 0.8:0.2 mL ratio (fat:PRP) for small areas and 9:1 mL for larger areas. PRP was injected either mixed or in adjacent tissue planes depending on the recipient site.

Outcome Assessment

Postoperative follow-up examinations were conducted at approximately 1 month and 6 month follow-up. During these visits, standardized clinical photography was performed, and complications were documented.

Subjective contour improvement was assessed using a 5-point scale

1. No noticeable improvement
2. Minimal improvement
3. Moderate improvement
4. Significant improvement and
5. Complete or optimal restoration.

Patient satisfaction was similarly evaluated using a 5-point scale

1. **Very Dissatisfied** - No visible improvement; area appears unnatural, asymmetrical, or irregular
2. **Dissatisfied** - Minimal aesthetic change; persistent contour irregularities, volume loss, or textural issues
3. **Neutral** - Mild improvement; some softening, volume enhancement, or blending, but not satisfactory overall
4. **Satisfied** - Noticeable improvement in shape, symmetry, or skin quality; meets expectations, and
5. **Very Satisfied** - Significant aesthetic enhancement with natural contour, good symmetry, and improved skin texture or color; exceeds expectations.

Contour improvement scores were assessed by the treating surgeon based on standardized clinical photographs obtained at each postoperative visit. Patient satisfaction scores were self-reported by patients at each follow-up visit. Neither assessment was performed by a blinded or independent evaluator. Complications were systematically recorded, including infection, seroma, hematoma, ecchymosis, numbness/tingling, dermatitis, fat necrosis, and wound dehiscence. The number of repeat fat grafting procedures was also documented.

Subgroup analyses

To further characterize outcomes across clinically distinct populations, pre-specified subgroup analyses were performed for three groups:

1. Burn patients (post-burn hypertrophic scar, keloid, or contracture)
2. Cancer patients (post-mastectomy breast reconstruction and head and neck oncoplastic reconstruction)
3. Patients with a history of radiation to the graft site. Subgroup comparisons evaluated complications, repeat grafting rates, and patient satisfaction scores at 1 month and 6 month follow-up using the same statistical methodology as the primary analysis.

Statistical analysis

The data was entered in Microsoft Excel 2010 version. Data was analyzed using Microsoft Excel 2010 and Epi Info 7.2.0. Descriptive and inferential statistical analysis were used in the present study. Results on continuous measurements were presented on Mean±SD [Min-Max] and results on categorical measurements were presented in Number [%]. Significance was assessed at 5% level of significance. For normally distributed continuous variables, Student's t-test was used for two-group comparisons; for non-normally distributed variables, Mann-Whitney U test was applied. Chi square test was used to compare categorical variables. Multivariate logistic regression analysis was performed to identify predictors of repeat fat grafting, adjusting for BMI, smoking status, history of radiation, diabetes, chemotherapy history, and indication for fat grafting. Because 128 patients underwent 193 procedures, with some patients contributing multiple procedures, outcomes were analyzed at the procedure level. A sensitivity analysis using generalized estimating

equations (GEE) with an exchangeable correlation structure was performed to account for within-patient clustering; results were consistent with the primary analysis. Subgroup analyses were pre-specified and considered exploratory. No correction for multiple comparisons was applied to subgroup analyses, and findings should be interpreted accordingly. A p value of <0.05 was considered statistically significant.

Results

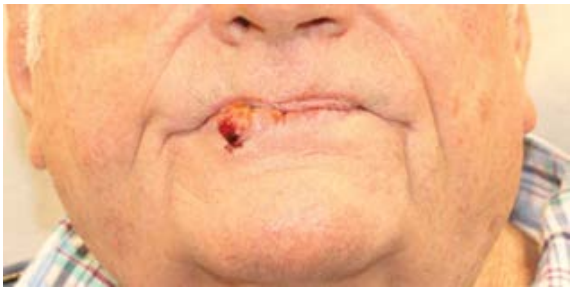
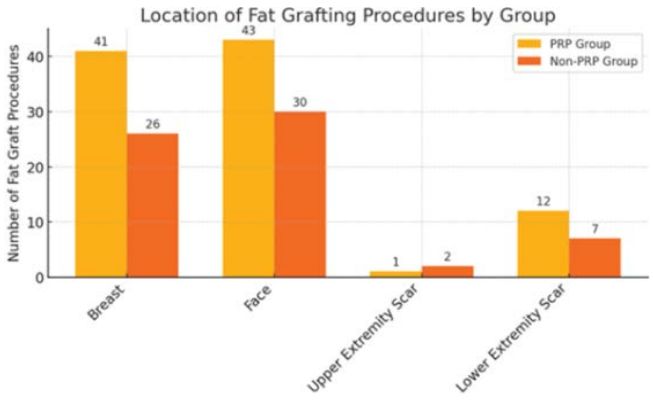


Figure 1: Preoperative photograph of a 77-year-old female with squamous cell carcinoma of the lower lip prior to surgical excision.



Graph 1: Location of fat grafting procedures by group

Table 1: Comparison of Baseline Characteristics Between PRP and Non-PRP Groups.

Parameter	PRP Group	Non-PRP Group	p-value
Age (Median ± IQR)	56.00 ± 39.50	52.00 ± 26.00	0.97
Gender	30	18	0.96
Male	90	55	
Female			
Race			
Asian	4	3	0.4
Black/African-American	27	11	
Hispanic/ Latino	1	2	
White	81	57	
BMI (Mean)	29.48	26.8	0.005
Smoking Status			
Current	11	5	0.001
Former	32	38	
Never	77	30	
Alcohol Use	51	30	0.45
Diabetes Mellitus	15	23	< 0.001
Hypertension	57	24	0.26
DVT	9	7	0.39
Hyperlipidemia	29	19	0.77
Indication for Fat Grafting			
Aesthetic	84	36	0.004
Post-Oncologic Reconstruction	36	37	
History of Breast Cancer	28	22	0.3
History of Radiation to fat graft site	15	16	0.09
History of Chemotherapy	11	16	0.01
Total number of repeat fat grafting			
2	16	9	0.43
3	3	2	
4	2	3	
5	1	3	

A total of 128 patients who underwent 193 fat grafting procedures were included in this study, with 120 undergoing fat grafting with PRP and 73 without PRP shown in table 1. Baseline characteristics were comparable between groups in terms of age, gender, and racial distribution ($p > 0.05$). However, notable clinical differences were observed. The PRP group had a significantly higher mean BMI (29.48 vs. 26.80; $p = 0.005$), a greater proportion of never-smokers (77 vs. 30; $p = 0.001$), and a lower prevalence of diabetes mellitus (15 vs. 23; $p< 0.001$). Additionally, aesthetic indications were more common in the PRP group, while the non-PRP group more frequently underwent grafting for oncologic reconstruction ($p = 0.004$). Prior chemotherapy was also more prevalent in the non-PRP group ($p = 0.01$). No significant differences were observed in alcohol use, hypertension, DVT, hyperlipidemia, history of breast cancer, or radiation to the graft site.

Figure 2: Postoperative image taken three weeks after lower lip squamous cell carcinoma excision and reconstruction using a bandoneon flap. Early healing of the surgical site is evident.

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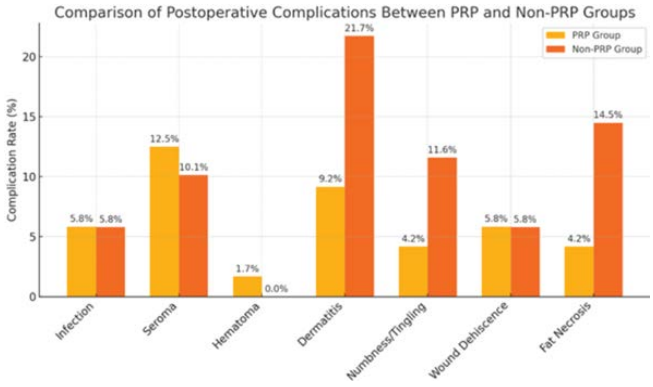


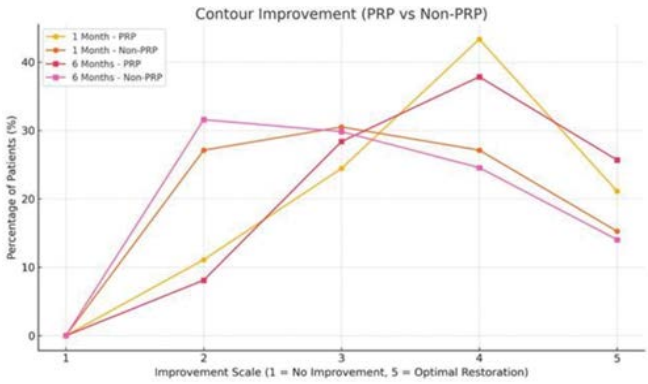
Graph 2: Compparision of postoperative complicatios between PRP and Non-PRP groups.

Table 2: Diagnosis.

Diagnosis	PRP Used (Yes)	PRP Not Used (No)	Total
Post-burn keloid scar	30	9	39
Post-burn scar contracture	37	17	54
Post-burn hypertrophic scar	26	7	33
Aesthetic - Breast	9	2	11
Aesthetic - Face	20	11	31
Breast Post-Mastectomy Reconstruction	30	29	59
Aesthetic - Buttock	4	1	5
Face - Oncologic Reconstruction	6	8	14

In terms of diagnosis shown in table 2, PRP was most frequently utilized in burn scars (37 vs 54), keloid scars (30 vs 39), and post-mastectomy breast reconstruction (30 vs 59). Comparatively no PRP use was noted in aesthetic facial procedures (20 vs 31) and facial oncoplastic reconstructions (20 vs 31). However, the association between diagnosis type and PRP use was not statistically significant (p = 0.44).

Figure 3: Three-month postoperative image of the same patient following three additional procedures, including PRP-assisted fat grafting and multiple soft tissue releases. Surgical interventions included release of scar contracture of the lower lip using a V–Y advancement flap, midline buccal sulcus release with frenulum excision, and Z-plasty of the central vermilion. Fat grafting was performed using an emulsified mixture at a ratio of 0.8 mL fat to 0.2 mL PRP to improve perioral contour and skin quality.



Graph 3: Line Graph for Contour Score over time.

Table 3: Procedural Characteristics Between PRP and Non-PRP Groups.

Parameter	PRP Group	Non-PRP Group
Fat Volume Harvested	507.13 ± 607.18	413.81 ± 340.62
Location of Fat Graft		
Breast	41	26
Face	43	30
Upper Extremity Scar	1	2
Lower Extremity Scar	12	7
Tumescent volume injected at recipient site (ml)	104.24 ± 179.10	133.33 ± 168.89
Concomitant 5-FU Kenalog	43	20

Procedurally, the PRP group had higher mean volumes of both harvested fat (507.13 ± 607.18 mL) compared to the non-PRP group (413.81 ± 340.62 mL). As shown in Table 3, the most common grafting sites in both groups were the face and the breast, with 43 facial and 41 breast procedures in the PRP group, compared to 30 facial and 26 breast procedures in the non-PRP group (graph 1). The average volume of tumescent solution injected at the recipient site was 104.24 mL in the PRP group and 133.33 mL in the non-PRP group. Concomitant 5-FU/Kenalog injections for hypertrophic or keloid scars were administered in 43 patients in the PRP group and 20 in the non-PRP group.

Figure 4: Markings for PRP-enhanced fat grafting in a 71-year-old female with a history of right-sided ductal carcinoma in situ (DCIS), treated with lumpectomy and radiation in 2011. Markings identify the abdominal donor site for fat harvest and the recipient zones in the right breast.

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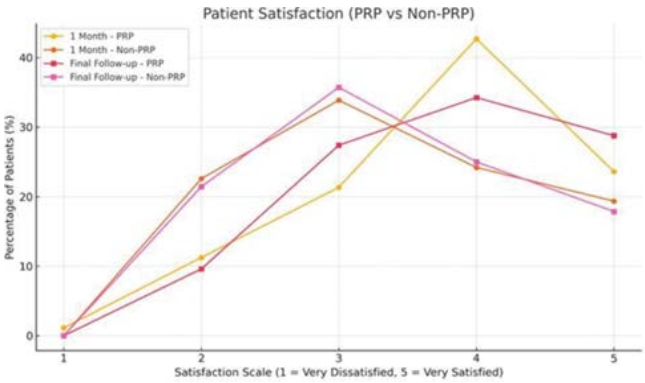
Figure 5: Image of the same patient to address breast asymmetry and radiation-induced scarring in October 2024.



Graph 4: Line Graph for Patient Satisfaction Score over time.

Postoperative complications (table 4 and graph 2) were largely comparable, though some differences were significant. The non-PRP group experienced significantly higher rates of fat necrosis (16.9% vs. 4.2%; p = 0.01), dermatitis (22.4% vs. 9.2%; p = 0.02), and numbness or tingling (11.3% vs. 4.2%; p = 0.05). Rates of infection, seroma, hematoma, and wound dehiscence did not differ significantly. Aesthetic outcomes favored the PRP group. At one month, patients receiving PRP demonstrated significantly greater contour improvement, compared to the non-PRP group (p = 0.03) (graph 3). This improvement persisted at 6-month follow-up, where the PRP group demonstrated significantly higher contour scores compared to the non-PRP group (p = 0.003). Patient satisfaction mirrored contour outcomes. At one month, PRP patients reported being satisfied or very satisfied, compared to the non-PRP group (p = 0.04). Although satisfaction at 6 month follow-up was higher in the PRP group, this difference did not reach statistical significance (p = 0.10) (graph 4). Regarding graft maintenance, repeat fat grafting was not significantly different between groups (p = 0.11), and the average number of repeat procedures was also similar (p = 0.14).

Table 4: Complications, Outcomes, and Patient Satisfaction Between PRP and Non-PRP Groups.

Parameter	PRP Group	Non-PRP Group	p-value
Complications			
Infection	7	4	0.99
Seroma	15	7	0.62
Hematoma	2	0	0.28
Dermatitis	11	15	0.02
Numbness/Tingling	5	8	0.05
Wound Dehiscence	7	4	0.98
Fat Necrosis	5	10	0.01
Contour scores at 1 month			
1	0	0	0.03
2	10	16	
3	22	18	
4	39	16	
5	19	9	
Patient Satisfaction scores at 1 month			
1	1	0	0.04
2	10	14	
3	19	21	
4	38	15	
5	21	12	
Contour scores at final follow-up			
1	0	0	0.003
2	6	18	
3	21	17	
4	28	14	
5	19	8	
Patient Satisfaction scores at final follow-up			
1	0	0	0.1
2	7	12	
3	20	20	
4	25	14	
5	21	10	
Graft Maintenance Indicators			
Repeat Fat Grafting			
Yes	33	27	0.11
No	87	43	
If Yes, total how many times?	2.28 ± 0.94	2.79 ± 1.32	0.14
Mean ± SD	(2.00 ± 2.00)	(2.00 ± 0.00)	
(Median ± IQR)			

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Table 5: Predictors of Repeat Fat Grafting.

Variable	Estimate	Standard Error	z	Wald Statistic	df	p-value
(Intercept)	-2.43	0.96	-2.54	6.45	1	0.01
BMI	0.05	0.02	2.08	4.32	1	0.04
Smoking Status (Former)	0.24	0.63	0.39	0.15	1	0.7
Smoking Status (Never)	0.16	0.6	0.26	0.07	1	0.79
History of Radiation (Yes)	0.31	0.43	0.71	0.51	1	0.48
Diabetes (Yes)	0.17	0.42	0.41	0.17	1	0.68
History of Chemotherapy (Yes)	0.42	0.47	0.9	0.8	1	0.37
Indication of fat grafting (Aesthetic Reconstruction)	-0.05	0.45	-0.11	0.01	1	0.92

Figures 6 and 7: Postoperative image following the two fat grafting sessions. In the first session, 185 mL of emulsified fat mixed with 9 mL of PRP (9:1 ratio) was injected into the right breast. Early improvements in volume and contour are seen.

The second session of fat grafting was performed four months after the initial procedure. An additional 70 mL of fat mixed with 7 mL of PRP (9:1 ratio) was injected. The image demonstrates improved breast symmetry, contour, and soft tissue texture.

Multivariate analysis identified BMI as the only statistically significant predictor of repeat fat grafting (p=0.04), with higher BMI associated with increased likelihood of requiring additional procedures. Smoking status, diabetes, history of radiation, chemotherapy, and indication for grafting were not significant predictors as shown in table 5. When analyzing complications associated with repeat grafting, fat necrosis (p = 0.01) and wound dehiscence (p = 0.0022) were found to be significantly associated with the need for additional grafting, suggesting that these complications may serve as clinical indicators for potential graft failure as shown in table 6.

Subgroup Analyses

Burn Subgroup (PRP n=51, Non-PRP n=22)

In the burn subgroup (Table 7), comprising patients with post-burn hypertrophic scars, keloids, and scar contractures, no significant differences in complication rates were observed between the PRP and non-PRP groups. Rates of ecchymosis (11.8% vs. 9.1%, p=0.70), numbness (5.9% vs. 13.6%, p=0.20), dermatitis (9.8% vs. 4.5%, p=0.40), fat necrosis (2.0% vs. 0%, p=0.50), and wound dehiscence (5.9% vs. 18.2%, p=0.11) were all comparable. Neither group experienced infection, seroma, or hematoma in this subgroup. Repeat fat grafting was required in 37.3% of PRP patients versus 45.5% of non-PRP patients, a difference that did not reach significance (p=0.50). Patient satisfaction at 1 month was nearly identical between groups (mean 3.91 vs. 3.90; p=0.71). However, at 6 month follow-up, the PRP group demonstrated significantly higher satisfaction scores (mean 3.57 vs. 3.26; p=0.03), suggesting a durable benefit of PRP augmentation in burn-related fat grafting despite comparable early outcomes and complication profiles.

Table 6: Repeat Grafting vs Complications.

Complication	Repeat Grafting: Yes (n)	Repeat Grafting: No (n)	Total Cases with Complication (n)	Chi-square	p-value
Infection	4	7	11	0.12	0.73
Seroma	7	15	22	2.18	0.34
Hematoma	0	2	2	0.92	0.34
Ecchymosis	9	23	32	0.21	0.64
Numbness/Tingling	7	6	13	3.33	0.07
Skin Discoloration	11	15	26	1.6	0.21
Fat Necrosis	9	6	15	6.09	0.01
Wound Dehiscence	8	3	11	9.37	0.0022

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Table 7: Subgroup Analysis of Complications, Repeat Grafting, and Patient Satisfaction by PRP Status.

Outcome	Burn Subgroup (n=73)	Cancer Subgroup (n=73)	Radiation Subgroup (n=31)
(PRP / Non-PRP)	51 / 22	36 / 37	15 / 16
	%(p-value)	%(p-value)	%(p-value)
Infection	0.0 / 0.0	11.1 / 21.6 (p=0.20)	13.3 / 12.5 (p=1.0)
Seroma	0.0 / 0.0	25.0 / 29.7 (p=0.60)	26.7 / 25.0 (p=1.0)
Hematoma	0.0 / 0.0	5.6 / 10.8 (p=0.40)	0.0 / 0.0
Fat Necrosis	2.0 / 0.0 (p=0.50)	8.3 / 21.6 (p=0.10)	6.7 / 18.8 (p=0.30)
Wound Dehiscence	5.9/ 18.2 (p=0.11)	0.0 / 0.0	20.0 / 0.0 (p=0.06)
Ecchymosis	11.8 / 9.1 (p=0.70)	30.6 / 16.2 (p=0.10)	0.0 / 12.5 (p=0.10)
Numbness	5.9 / 13.6 (p=0.20)	5.6 / 16.2 (p=0.10)	0.0 / 0.0
Dermatitis	9.8 / 4.5 (p=0.40)	11.1 / 24.3 (p=0.10)	0.0 / 12.5 (p=0.10)
Repeat Fat Grafting (%)	37.3 / 45.5 (p=0.50)	33.3 / 40.5 (p=0.50)	26.7 / 43.8 (p=0.30)
Patient Satisfaction (1 month, Mean)	3.91 / 3.90 (p=0.71)	4.5 / 4.2 (p=0.10)	3.90 / 4.00 (p=0.63)
Patient Satisfaction (6 month, Mean)	3.57 / 3.26 (p=0.03)*	3.70 / 3.16 (p=0.02)*	3.75 / 3.07 (p=0.06)

Cancer Subgroup (PRP n=36, Non-PRP n=37)

In patients undergoing fat grafting for oncologic reconstruction (table 7), including post-mastectomy breast reconstruction and head and neck oncologic reconstruction (figures 1-3); the PRP and non-PRP groups showed broadly comparable complication rates. Infection (11.1% vs. 21.6%, p=0.20), seroma (25.0% vs. 29.7%, p=0.60), hematoma (5.6% vs. 10.8%, p=0.40), ecchymosis (30.6% vs. 16.2%, p=0.10), numbness (5.6% vs. 16.2%, p=0.10), dermatitis (11.1% vs. 24.3%, p=0.10), and fat necrosis (8.3% vs. 21.6%, p=0.10) did not differ significantly, though trends consistently favored the PRP group. No wound dehiscence was observed in either group. Repeat grafting was required in 33.3% of PRP versus 40.5% of non-PRP patients (p=0.50). While patient satisfaction at 1 month was higher in the PRP group (mean 4.5 vs. 4.2; p=0.10), this did not reach significance. At final follow-up, however, PRP patients reported significantly higher satisfaction (mean 3.70 vs. 3.16; p=0.02).

Radiation Subgroup (PRP n=15, Non-PRP n=16)

In patients with a documented history of radiation to the graft site (Table 7) (figures 4-7), complication rates were comparable between groups. Infection (13.3% vs. 12.5%, p=1.0), seroma (26.7% vs. 25.0%, p=1.0), ecchymosis (0% vs. 12.5%, p=0.10), dermatitis (0% vs. 12.5%, p=0.10), and fat necrosis (6.7% vs. 18.8%, p=0.30) were all statistically similar, though trends again favored the PRP group. No hematoma or numbness was recorded in either group. Notably, wound dehiscence occurred in 20% of the PRP group versus 0% of the non-PRP group (p=0.06). This difference did not reach statistical significance and must be interpreted with caution given the small cohort size (n=31). Repeat grafting was performed in 26.7% vs. 43.8% of patients (p=0.30). At 1 month, satisfaction scores were nearly identical (mean 3.90 vs. 4.00; p=0.63). At final follow-up, the PRP group again trended toward higher satisfaction (mean 3.75 vs. 3.07; p=0.06), approaching but not reaching statistical significance in this smaller cohort.

Discussion

In this retrospective cohort study, PRP augmentation in autologous fat grafting was associated with improved contour scores at 1 and 6 months, significantly higher patient satisfaction at 1 month (p=0.04), and lower rates of fat necrosis and dermatitis. Overall patient satisfaction at 6 months was higher in the PRP group but did not reach statistical significance (p=0.10). Repeat grafting rates were similar between groups. These findings must be interpreted in the context of significant baseline differences between groups, including higher diabetes prevalence, more oncologic indications, and greater chemotherapy exposure in the non-PRP group, factors that independently disadvantage graft outcomes and may account for a portion of the observed differences. Several clinical and experimental studies have

demonstrated improved graft survival with platelet rich plasma. A systematic review by Wu et al. reported significantly higher graft retention rates with platelet rich plasma compared to conventional fat grafting. i.e. fat graft survival ranged from 20.5 % to 54.8 % in the conventional fat grafting compared to 24.1 % to 89.2 % with platelet rich plasma augmentation, showing a significant improvement in graft retention and recovery outcomes [12]. Similarly a meta-analysis performed by Arkoubi et al highlighted that Patients receiving PRP with AFG exhibited markedly superior fat graft survival (0.34 [0.33, 0.35], $p < 0.00001$) alongside a substantially reduced recovery time (−2.67 [−4.95, −0.40], $p = 0.02$) [16]. Salgarello et al. also demonstrated improved aesthetic outcomes and volume maintenance in breast fat grafting when platelet rich plasma was added [17]. These findings align with the present study, where significantly better contour scores were observed at both early and late follow up, supporting the role of platelet rich plasma in enhancing angiogenesis and early graft integration [18]. Several baseline differences between groups merit specific discussion as potential confounders. The non-PRP group had a significantly higher prevalence of diabetes mellitus ($p<0.001$), a condition well established to impair angiogenesis, reduce tissue perfusion, and increase rates of fat necrosis and wound complications independent of any intervention. The non-PRP group also contained a higher proportion of oncologic reconstruction cases ($p=0.004$) and greater prior chemotherapy exposure ($p=0.01$), both of which are associated with compromised tissue vascularity and impaired healing. Patients undergoing aesthetic procedures, who were more prevalent in the PRP group, typically present with healthier baseline tissue and superior vascularity. These differences alone would be expected to produce better outcomes in the PRP group independent of PRP itself. Without propensity score matching or indication-stratified analysis, it is not possible to fully separate the effect of PRP from the effect of case mix. However, not all studies have shown consistent long-term benefits. Modarressi et al reported that while platelet rich plasma improves early graft viability, its effect on long term volume retention may be limited [19]. The growing body of evidence highlighted that variability in preparation techniques and platelet concentrations contributes to inconsistent clinical outcomes [20-22]. These observations may explain why, in the present study, improved contour outcomes did not translate into a significant reduction in repeat grafting rates. It is likely that platelet rich plasma primarily enhances early vascularization rather than sustained long term graft volume. The reduction in fat necrosis observed in this study is supported by prior work demonstrating improved tissue perfusion and reduced ischemic injury with platelet rich plasma [23]. Zu et al. showed enhanced tissue regeneration and reduced inflammatory response with platelet rich plasma application [13]. In contrast, some studies have reported no significant difference in complication rates, suggesting that the benefits of platelet rich plasma may depend on patient selection and recipient site characteristics [24-25]. The lower rates of dermatitis observed in this study may be attributed to the anti-inflammatory and wound healing properties of platelet rich plasma, as described in earlier experimental studies [26-27]. Patient satisfaction outcomes in the literature remain variable. Gentile et al. reported improved early satisfaction with platelet rich plasma, although long term differences were less pronounced [23]. This pattern is consistent with the present findings, where satisfaction was significantly higher at one month but not at final follow up. This may reflect the influence of early volume retention on patient perception, while long term satisfaction is influenced by multiple factors including repeat procedures and overall aesthetic stability. Subgroup analyses in this study provide further insight into the role of platelet rich plasma in different clinical contexts. In burn and oncologic subgroups, significantly higher long-term satisfaction was observed in the platelet rich plasma group. This is supported by studies suggesting that platelet rich plasma may have greater efficacy in compromised or poorly vascularized tissues by enhancing angiogenesis and tissue regeneration [23-28]. The trends observed in the radiation subgroup in this study are consistent with these findings. The identification of body mass index as an independent predictor of repeat grafting is supported by existing evidence that systemic factors influence graft survival. Studies have shown that metabolic factors, including obesity, may impair microcirculation and increase inflammatory responses, thereby affecting graft retention [30-31]. This may explain why the local benefits of platelet rich plasma were insufficient to reduce repeat procedures in patients with higher body mass index. The association between fat necrosis and wound dehiscence with repeat grafting observed in this study is clinically relevant. These complications likely reflect poor graft integration and compromised healing, which have been identified as key determinants of graft failure in previous studies [32-35]. Early identification of these complications may help guide timely intervention and improve outcomes. It is also notable that the PRP group had a significantly higher mean BMI at baseline (29.48 vs. 26.80, $p=0.005$). If higher BMI independently drives the need for repeat grafting, and the PRP group carried this disadvantage, then the absence of a significant difference in repeat grafting rates between groups may actually reflect a relative benefit of PRP that is being masked by this imbalance a finding that warrants prospective investigation. This study has several important limitations that must be acknowledged. First, the retrospective non-randomized design introduces substantial selection bias; patients with more favorable tissue environments were more likely to receive PRP, confounding all comparisons. Second, the major baseline imbalances including BMI, diabetes prevalence, smoking status, surgical indication, and prior chemotherapy were adjusted for only in the repeat grafting model, not across all primary outcomes. Third, subjective

outcomes were assessed without blinding; contour scoring was performed by the treating surgeon and patient satisfaction was self-reported, introducing the possibility of performance and detection bias. Fourth, follow-up was limited to 6 months, which is insufficient to evaluate true long-term graft retention. Sixth, subgroup analyses were exploratory and underpowered, particularly the radiation cohort (n=31), and should not be used to draw definitive conclusions. Despite these limitations, the single-center design ensures consistency in surgical technique and PRP preparation protocol, providing a degree of internal standardization not achievable in multi-center studies. The present findings are best interpreted as hypothesis-generating and provide a rationale for prospective randomized investigation.

Conclusion

The findings of this retrospective cohort study suggest that PRP augmentation may be associated with improved early contour outcomes and lower rates of fat necrosis, though these associations should be interpreted with caution given significant baseline differences between groups, the non-randomized design, and the absence of blinded outcome assessment. Patient satisfaction was significantly higher at 1 month in the PRP group; however, overall satisfaction at 6 months did not reach statistical significance. Subgroup analyses in burn and oncologic cohorts demonstrated higher long-term satisfaction with PRP, but these findings are exploratory. BMI was the only independent predictor of repeat grafting. Prospective randomized trials with standardized PRP protocols, blinded outcome assessment, matched patient populations, and longer follow-up are needed to definitively establish the role of PRP in autologous fat grafting.

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