Zagazig University Medical Journal
www.zumj.journals.ekb.eg
https://doi.org/10.21608/zumj.2025.352947.3797 Volume 31, Issue 4, April . 2025
Manuscript id: ZUMJ-2501-3797
Doi: 10.21608/ZUMJ.2025.352947.3797

ORIGINAL ARTICLE

Comparison Between Autogenous Fat Grafting and Platelet Rich Plasma (PRP) in Sciatic Nerve Graft Regeneration in Male Albino Rats

Ahmed Abohashem Azab[1], Mahmoud Elsayed Gouda [1], Nourhan Ibrahim Abdelhamid Abdelaziz [2*], Raafat Abd Ellatif Anani [1]
Plastic and Reconstructive surgery, Faculty of Medicine, Zagazig University, Egypt
Plastic Surgery Resident, Sharq EL-Madinah Hospital, Alexandria, Egypt
***Corresponding author:** NourhanIbrahim Abdelhamid Abdelaziz
Email: Dr.nourhanibrahim@gmail.com

Submit date: 14-01-2025
Accept date: 25-01-2025

ABSTRACT

Background: Autogenous fat grafting and platelet-rich plasma (PRP) have shown potential in enhancing nerve regeneration due to their biological properties, including growth factor release and anti-inflammatory effects. The present work aimed to compare the regenerative outcomes in peripheral nerves treated with fat graft versus PRP, focusing on key indicators of nerve growth and function in male albino rats.

Methods: In this experimental study, 18 male albino rats (250-350 g) were included, with 4 serving as PRP donors. In Group A (left side), 0.3 ml of abdominal fat was injected around the epineurial nerve graft repair site, while Group B (right side) received 0.3 ml of activated PRP. At 12 weeks, 15 mm sciatic nerve segments were harvested, fixed in formalin, and analyzed histopathologically to evaluate the number of regenerated nerve fibers, myelinated axons, axonal diameter, and neurotization index.

Results: Group A (Fat Graft) demonstrated significantly higher proximal myelinated axons (196.36 ± 68.36, p=0.026) and distal axons (173.71 ± 59.32, p=0.020) compared to Group B (PRP), which had 147.29 ± 54.91 proximal axons and 115.86 ± 43.10 distal axons. Proximal regenerated fibers were also higher in Group A (313.28 ± 87.34 vs. 252.57 ± 69.08). The distal nerve fiber count was significantly higher (p=0.005) in Group A (248.21±54.45) compared to Group B (192.14±55.06). The neurotization index was significantly higher (p=0.007) in Group A, with a mean 89.16 compared to Group B, which had a mean 79.36. Autogenous fat grafting was associated with better outcomes in all measured parameters.

Conclusion: Autogenous fat grafting enhanced nerve graft regeneration compared to PRP in male albino rats. The higher neurotization index indicates that autogenous fat grafting not only promotes nerve fiber regeneration but also enhances graft integration and functional recovery, which is crucial for restoring nerve function.

Keywords: Autogenous Fat Grafting, Platelet Rich Plasma, Sciatic Nerve Graft Regeneration, Albino Rats.

INTRODUCTION

Peripheral nerve injuries are a significant medical challenge due to their potential to cause long-term functional impairment and disability. Various approaches have been investigated to improve nerve regeneration, including the use of biological and synthetic materials as grafts. Among these, autogenous fat grafting and platelet-rich plasma (PRP) have gained attention due

to their regenerative potential. Both methods have been employed in preclinical and clinical settings, yet their comparative efficacy in nerve repair remains underexplored, particularly in animal models like male albino rats [1].

Autogenous fat grafting involves the transplantation of the patient's own adipose tissue to the site of injury. This approach provides a matrix rich in adipose-derived stem cells (ADSCs), which have been shown to enhance neuroregeneration through the release of growth factors and differentiation into Schwann cell-like phenotypes. Additionally, fat grafting has the advantage of being biocompatible and relatively easy to harvest. However, challenges such as fat resorption and the variability in graft survival have been reported, making its efficacy inconsistent in some cases [2].

On the other hand, PRP is a concentrated solution of autologous platelets derived from whole blood, rich in growth factors such as platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF), and transforming growth factor-beta (TGF-β). These factors are known to promote angiogenesis, cell proliferation, and differentiation, all of which are essential for nerve regeneration. PRP's ease of preparation and application, coupled with its minimal side effects, makes it an appealing option for peripheral nerve repair. Despite its potential, the longevity of PRP's effects and its optimal concentration for nerve regeneration remain areas of active investigation [3].

In the context of sciatic nerve injuries, which are among the most studied models of peripheral nerve damage in rodents, the use of fat grafting and PRP has shown promising results. Both methods have demonstrated the ability to support axonal regrowth, reduce inflammation, and improve functional recovery [4]. Recent advances in nerve regeneration research suggest that combining multiple therapeutic modalities might enhance outcomes. For instance, using fat grafting as a scaffold in conjunction with PRP could theoretically combine the benefits of both approaches [5].

Male albino rats are frequently used in preclinical studies due to their genetic homogeneity, ease of handling, and well-characterized anatomy. These factors make them ideal subjects for evaluating the regenerative potential of fat grafting and PRP in sciatic nerve injuries. Additionally, the standardized use of such models allows for better comparison and reproducibility of results across studies [6].

While autogenous fat grafting and PRP each hold promises for sciatic nerve regeneration, their mechanisms of action, efficacy, and potential limitations differ significantly. A comparative analysis in an experimental setting could elucidate the relative advantages and disadvantages of each technique, guiding future clinical applications. Understanding these differences is crucial for optimizing treatment strategies for peripheral nerve injuries [7,8]. So, we aimed at this study to compare the regenerative outcomes in peripheral nerves treated with fat graft versus PRP, focusing on key indicators of nerve growth and function in male albino rats. in male albino rats.

METHODS

Starting from May, 2023 and ending in January, 2024, this experimental and histo-pathological study included (18) male albino rats with an average weight of 250-350 grams that were all subjected to the experiment four of them were used as donors of blood; the Institutional animal care and Use committee of the Faculty of Medicine, Zagazig University, approved the study (ZU-IACUC/3/F/112/2023). Following the recommendations of the Declarations of Helsinki as well as the European Community's rules for the use of experimental animals, the experiment was carried out.

All the maneuvers carried on in this experiment concerning the rats were highly ethical and merciful. All rats received proper anesthesia ketamine / Xylazine cocktail Intra-peritoneal (0.08-0.09mg/gram body weight) + (Xylazine 10mg per mL with a dosage of 0.1ml/100-gram rat weight) during all surgical procedures", Sciatic nerves were exposed on both sides, then 1cm of the sciatic nerves (on both sides) was harvested as nerve grafts then were switched into the other side.

Graft repair of both nerve grafts was done using nylon 10/0 using microsurgical techniques on both sides using magnification power 20X. On the left side: of the same (14) male albino rats (Group A) (4 rats decayed): 0.3 ml of processed fat was injected around the site of the epineurial nerve graft repair. On the right side: of the (14) male albino rats (Group B) (4 rats decayed)" 0.3 ml of activated PRP was injected around the site of the epineurial nerve graft repair.

Nano-fat preparation and processing

The harvested fat gained from rat's abdomen was minced in stainless steel plate using a 15 surgical blade then further processed into Nanofat using two luer-lock 3mL syringes connected via a three-way stopcock connector with an inner diameter of 2.0 mm shuffling between the syringes up to 25-30 times

PRP preparation and characterization

About 1.5 ml fresh bloods from 1 rat with 10% sodium citrate, (anticoagulant solution) was obtained in a sterile tube from inferior vena cava by open approaches after being anaesthetized. Blood was centrifuged immediately at (2400 RPM) (soft spin) around for 10 minutes

The upper layer was transferred with a sterile pipette to another tube without anticoagulant and re-centrifuged at a higher speed (3500 RPM) (hard spin) for 5 minutes. Then 0.6ml PRP was obtained and activated with 10% calcium chloride and ready to be used for 2 rats in each time

Surgical Procedure

The experimental procedures were conducted on anesthetized rats using an intraperitoneal ketamine and xylazine cocktail (0.08–0.09 mg/g body weight ketamine, and 10 mg/mL xylazine at a dosage of 0.1 mL/100 g). Hair was shaved from the hind limbs, abdomen, and mid-back for surgical preparation. Following sterilization of the abdominal skin with 10% povidone-iodine, a surgical incision was made to harvest subcutaneous abdominal fat for autologous fat grafting. The abdominal wounds were then sutured in a continuous fashion using polypropylene 4-0 sutures.

Subsequently, the rats were placed prone on a wooden operating board. A lateral skin incision, initiated 0.5 cm from the spine and extending above the iliac crest, exposed the sciatic nerve through careful blunt dissection between the biceps femoris and gluteal muscle groups. A segment of the sciatic nerve (1 cm) was resected bilaterally after meticulous handling with microsurgical tools. The harvested nerve segments were exchanged between the left and right sides, and immediate repair of the grafts was performed using nylon 10-0 sutures under a surgical microscope. On the left side (Group A), the repair site was infiltrated with 0.3 mL of processed fat, while on the right side (Group B), 0.3 mL of platelet-rich plasma (PRP) was used.

The surgical procedure was completed by muscle approximation and skin suturing with polypropylene 4-0 sutures, followed by povidone-iodine application to the skin. The entire operation was carried out using a surgical microscope and microsurgical instruments to ensure precise nerve dissection, handling, and repair. This detailed approach aimed to study the comparative effects of processed fat and PRP on sciatic nerve graft repair.

Follow up

Postoperatively, the rats were closely monitored during surgery and recovery, housed individually with food and water

provided thrice daily. Daily assessments during the first four weeks included feeding, cleaning, wound care, and a 7-day antibiotic regimen (tetracycline, 0.8 mg/100 g body weight in drinking water), transitioning to checks every three days up to 12 weeks. After wound healing, sutures were removed, and rats were placed in communal cages two weeks post-surgery. Recovery was evaluated by monitoring motor improvements (limb movement during crawling) and sensory recovery (pin-prick test), with assessments recorded at 6 and 12 weeks to analyze the effects of processed fat and PRP in sciatic nerve repair.

Biopsy preparation and histological evaluation

At the end of the 12th postoperative week, all 14 surviving rats were euthanized humanely using an intraperitoneal overdose of anesthesia (270 mg/kg, triple the surgical dose). The sciatic nerves on both sides were surgically exposed, and a 15 mm segment, centered on the epineurial graft repair site, was excised. To ensure proper orientation, the proximal stump of each nerve segment was marked with a suture knot. The harvested nerve samples were fixed in 10% formalin within sterile collection tubes and subsequently sent to the pathology laboratory for histopathological evaluation.

Histopathological Examination:

After 48 hours in formalin, the harvested nerve samples were washed in distilled water for 30 minutes to remove residual formalin, then embedded in paraffin wax blocks. These blocks were sectioned into histologic slices 4–5 microns thick and stained separately using Hematoxylin and Eosin. Histologic evaluation was conducted under light microscopy by a blinded professional examiner who was unaware of the experimental groups. The number of myelinated axons proximal and distal to the epineurial nerve graft repair was counted at 400X magnification, using a series of adjacent sections along the longitudinal axis of the fascicles. An average count was determined based on these observations.

Using the axonal counts, a neurotization index was calculated for both experimental groups (Group A and Group B) using the formula: (Average number of nerve fibers in the distal segment / Average number of nerve fibers in the proximal segment) × 100. Key histological parameters measured included the number of regenerated nerve fibers, the number of myelinated axons, axonal diameter, and the neurotization index.

Statistical Analysis:

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation, median and interquartile range (IQR). Significance of the obtained results was judged at the 5% level.

RESULTS

All 14 rats tolerated the procedures well without major postoperative complications. Mobility returned within 1–2 hours, and normal activities, such as drinking, resumed by 3 hours post-surgery. Skin sutures were removed after 7 days, with satisfactory wound healing in all cases. Mild skin infections and partial wound dehiscence occurred in 2 rats (one in each group) (Table 1).

Post-operatively, the nerve diameter increased in both groups. Group A had a mean diameter of 1.71±0.28 mm1.71, compared to Group B's 1.85±0.29 mm1.85. Although Group B showed a slightly larger post-operative diameter, the difference was not statistically significant ($t = 1.82$, $p = 0.11$) (Table 2).

At 3 weeks postoperatively, paralysis was observed in 11 rats in Group A and 12 in Group B, with partial weakness reported in 3 rats in Group A and 2 in Group B, and no

cases of complete recovery in either group. Similarly, hypothesia was reported in 12 rats in Group A and 13 in Group B, with partial recovery in 2 rats in Group A and 1 in Group B, and no cases of complete recovery (Table 3).

At 6 weeks, paralysis cases decreased to 6 in Group A and 7 in Group B, with partial weakness in 6 rats in Group A and 5 in Group B, and 2 cases of complete recovery in each group. Hypothesia cases were equal in both groups (6 each), with partial recovery in 7 rats in both groups and 1 case of complete recovery in each group. By 12 weeks, neither group exhibited paralysis or hypothesia, with partial weakness observed in 2 rats in Group A and 3 in Group B. Complete recovery rates were 12 in Group A and 11 in Group B for both conditions (Table 3).

Neither Group A (left side) nor Group B (right side) exhibited cases of seroma, and no cases of hematoma were observed in either group. Both groups had 1 case each of wound infection and wound dehiscence. 4 rats died due to anesthesia related overdose (Table 4).

Histo-pathologic Evaluation

Group A - Proximal Segment of Sciatic Nerve Autograft Treated with Adipocytes:

The epineural, perineural, and endoneural tissues appeared intact and healthy. Nerve cell bodies and their neurofibrils displayed proper arrangement and good micro-morphological integrity. Additionally, evidence of regenerated nerve fibers was observed, indicating successful nerve repair and regeneration in the proximal segment (Figure 1A).

Group A - Distal Segment of Sciatic Nerve Autograft Treated with Adipocytes:

The epineural, perineural, and endoneural tissues appeared healthy and intact. Nerve cell bodies and their neurofibrils were properly arranged, exhibiting good micro-morphological integrity, consistent with effective nerve repair in the distal segment (Figure 1B).

Group B - Proximal Segment of Sciatic Nerve Autograft Treated with PRP:

Findings included epineural and perineural edema, mild congestion, and mild lymphocytic infiltration. Focal neuronal degeneration was observed in some areas, alongside mild peri-endoneural edema, indicating a less favorable regenerative response in the proximal segment compared to Group A (Figure 1C).

Group B - Distal Segment of Sciatic Nerve Autograft Treated with PRP:

There was evidence of epineural vascular dilatation and mild edema, which extended around the endoneurium. Peri-endoneural vascular dilatation, erythrocytic extravasation, and mild edema were also observed. Additionally, remnants of suture materials were detected, suggesting some localized inflammatory response and less optimal nerve repair in the distal segment (Figure 1D).

Number of Myelinated Nerve Axons

Group A (Fat Graft) exhibited a significantly higher number of myelinated nerve axons both proximally and distally compared to Group B (PRP). Proximally, Group A had a mean of 196.36 ± 68.36 axons versus 147.29 ± 54.91 in Group B ($p=0.013$). Distally, the mean for Group A was 173.71 ± 59.32 axons compared to 115.86 ± 43.10 in Group B ($p=0.020$). These results indicate that fat grafting supports enhanced myelination both proximally and distally, which may contribute to improved nerve structure and function (Table 5, Figure 2).

Number of Regenerated Nerve Fibers

Significant differences were observed in the number of regenerated nerve fibers between the two groups. Proximally, Group A had a mean of 313.28 ± 87.34 regenerated fibers, significantly higher than Group B's 252.57 ± 69.08 ($p=0.026$). Similarly, distally, Group A exhibited a mean of 248.21 ± 54.45 fibers compared to 192.14 ± 55.06 in Group B ($p=0.005$). These findings suggest that fat

grafting enhances nerve regeneration more effectively than PRP both proximally and distally.

The average axonal diameter was significantly larger in Group A (1.9 ± 0.031 µm) compared to Group B (0.4 ± 0.031 µm), with a p-value of 0.005. This result indicates that fat grafting is associated with better axonal morphology, potentially supporting improved nerve conduction and structural integrity compared to PRP treatment (Table 5).

Neurotization Index

The neurotization index, reflecting nerve integration and functional recovery, was slightly higher in Group A, with a median value of 90.19 compared to 86.26 in Group B (p=0.007). This suggests that fat grafting promotes superior nerve integration and functional outcomes compared to PRP, highlighting its potential as a more effective treatment for nerve repair (Table 5).

Table 1: Descriptive data of the studied rats

Species / Common Name	Strain / Breed	Weight Range	Sex (M, F)	Total Number	Source
Rat	**Albino Rat**	**250–350 gm**	**Male**	**14 rats (operated on both Sides)**	**Experimental Lab**

Table 2: Nerve diameter among the studied groups

	Lt side (group A)	***Rt side (group B)***	***T-test***	***P-value***
Pre operative nerve diameter(average/mm)	**1.3 + 0.23**	**1.38 + 0.21**	**1.47**	**0.16**
Post operative nerve diameter(average/mm)	**1.71 + 0.28**	**1.85 + 0.29**	**1.82**	**0.11**

Table 3: Motor and sensory Recovery among the studied groups:

MOTOR RECOVERY	3 Weeks				6 Weeks				12 Weeks			
	GROUP A	GROUP B	x2	p	GROUP A	GROUP B	x2	p	GROUP A	GROUP B	x2	p
PARALYSIS	11	12	0.48	0.64	6	7	0.26	0.8	0	0	0.47	0.64
PARTIAL WEAKNESS	3	2			6	5			2	3		
COMPLETE REVOVERY	0	0			2	2			12	11		
SENSORY RECOVERY	3 Weeks				6 Weeks				12 Weeks			
	GROUP A	GROUP B	x2	p	GROUP A	GROUP B	x2	p	GROUP A	GROUP B	x2	p
HYPOTHESIA	12	13	0.59	0.56	6	6	0	1	0	0	0.48	0.64
PARTIAL	2	1			7	7			2	3		
COMPLETE RECOVERY	0	0			1	1			12	11		

Table 4: Early postoperative Complications among the studied groups:

Morbidity	*Lt side (group A)*	*Rt side (group B)*	X2	P-value
Seroma	0	0	0	1
Hematoma	0	0		
Wound infection	1	1		
Wound dehiscence	1	1		

Table 5: Statistics for Regeneration Metrics among the studied groups

Parameter	Group A (Fat Graft)		Group B (PRP)		p-value
	Proximal	Distal	Proximal	Distal	
Number of Myelinated Nerve Axons	196.36 ± 68.36	173.71± 59.32	147.29 ± 54.91	115.86± 43.10	0.013
Number of regenerated Nerve fibers	313.28 ± 87.34	248.21± 54.45	252.57 ± 69.08	192.14± 55.06	0.026
Average axonal diameter (µm)	1.9 ± 0.031		0.4 ± 0.031		0.005
Neurotization Index	89.16 ± 7.53		79.36 ± 17.68		0.007

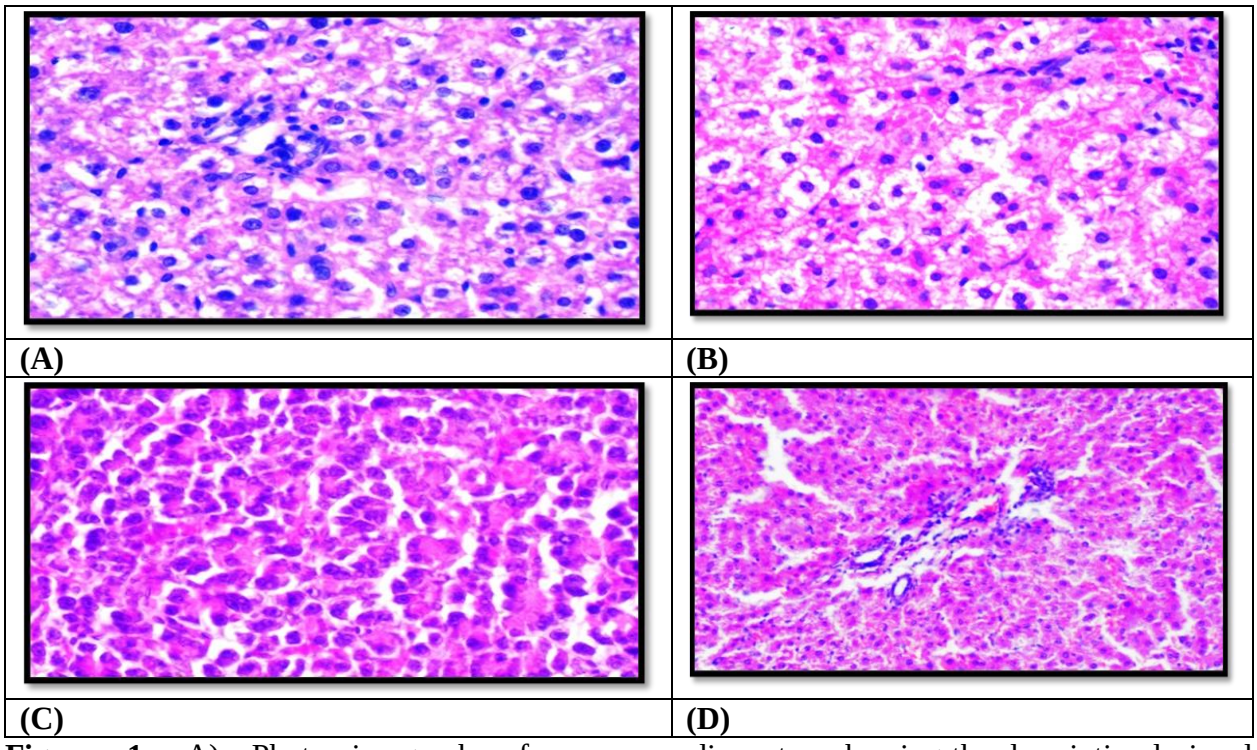
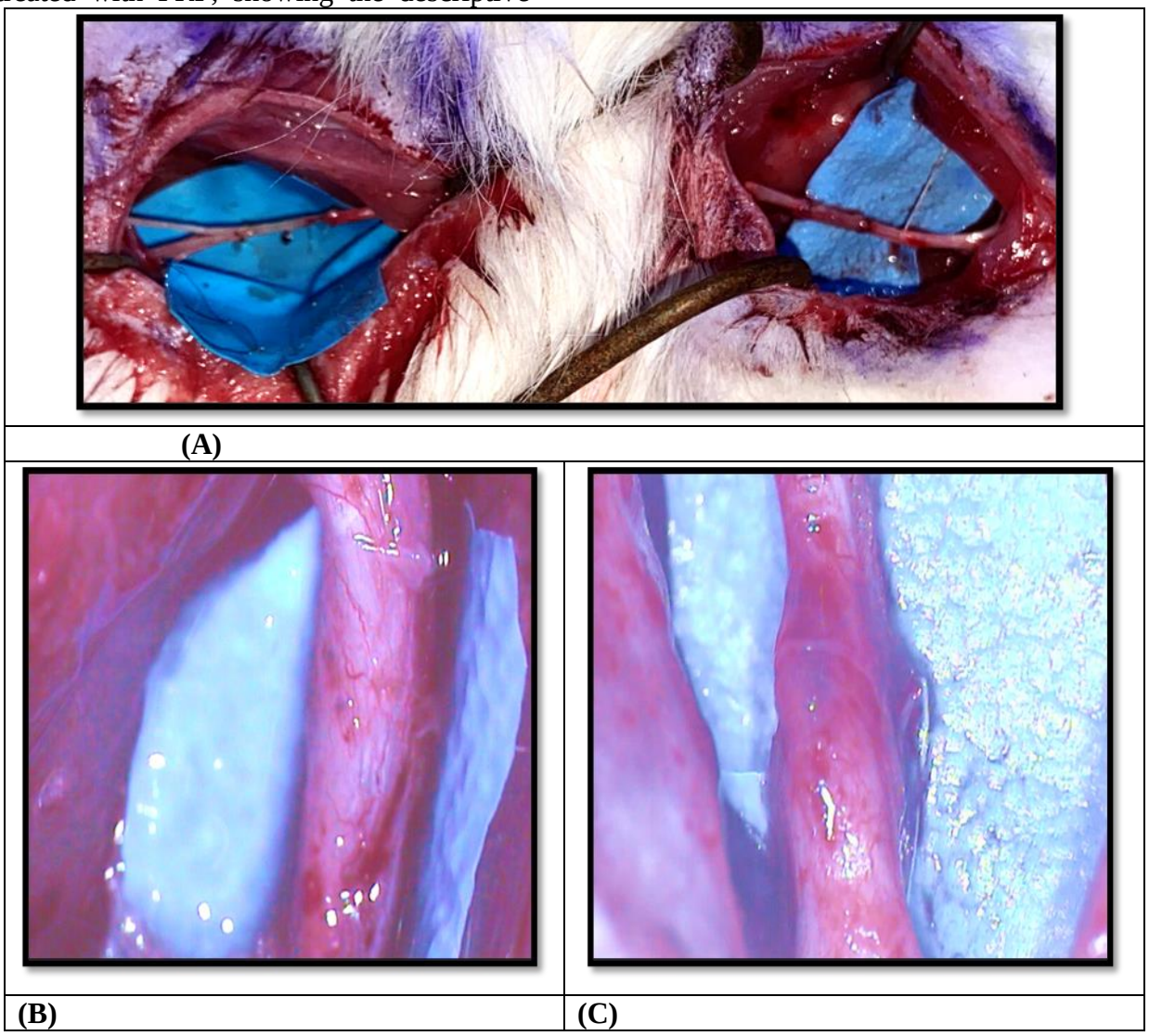


Figure 1: A) Photomicrographs from proximal segment of autograft sciatic nerve treated with adipocytes, showing the descriptive lesional findings, B) Photomicrographs from distal segment of autograft sciatic nerve treated with adipocytes, showing the descriptive lesional findings, C) Photomicrographs from proximal segment of autograft sciatic nerve treated with PRP, showing the descriptive lesional findings, D) Photomicrographs from

distal segment of autograft sciatic nerve treated with PRP, showing the descriptive lesional findings



(A)

(B) **(C)**

Figure (2): (A) sciatic nerve grafts were harvested & switched then nerve grafts repair were done on both sides by nylon 10/0, (B) Post-operative left sciatic nerve graft repair after 12 weeks, (C) Post-operative right sciatic nerve graft repair after 12 weeks

DISCUSSION

To increase nerve regeneration after nerve repair, some attempts were made to increase the proliferation and activation of SCs and improve vascularization around the nerve. Several studies had also demonstrated the delivery of support cells, such as SCs with GFs in an acellular nerve autograft [9-11], and local administration of GFs to the nerve graft site [12].

Traumatic injuries to peripheral nerves are commonly present after trauma and require the use of a nerve graft when tension-free neurorrhaphy is not possible. The use of nerve autografts is considered the gold standard to bridge these large defects. Regeneration is often suboptimal with incomplete target reinnervation, which could be attributed to axonal degeneration and fibrotic scar formation [13].

Fat grafting provides a source of adipose-derived stem cells (ADSCs) and creates a pro-regenerative environment, while PRP offers concentrated growth factors that may accelerate healing. Previous studies have demonstrated varying degrees of success with these

treatments, highlighting the need for a deeper understanding of their comparative efficacy. For example, one study found that fat grafts reduced perineural scarring and promoted nerve healing [14], while another noted the potential of PRP to promote angiogenesis and reduce inflammation in nerve injuries [15].

This study aimed to compare the effects of autogenous fat grafting and PRP on myelination, neurotization, axonal diameter, and overall nerve regeneration.

In our study, comparing the two treatment groups, Group A (Fat Graft) demonstrated a significantly higher number of proximal myelinated nerve axons (mean ± SD: 196.36 ± 68.36) compared to Group B (PRP), which had a mean of 147.29 ± 54.91 axons ($p = 0.013$) with a higher number of regenerated nerve fibers proximally, with a mean of 313.28 ± 87.34, compared to Group B 252.57 ± 69.08. This difference was statistically significant ($t = 2.03$, $p = 0.026$). The average axonal diameter in Group A is 1.9 ± 0.031 µm.

In parallel with our study, another study where nerve grafts taken from the other leg of the same rat were used to repair sciatic nerve injuries, ADSC transplant demonstrated improved regeneration. Specifically, the ADSCs increased the survival of spinal L5 ganglia neurons by 26.4%, improved sciatic nerve vascularization by 35.68%, and increased the number of myelin fibers in the proximal nerve by 41.87% [16].

Research has shown that ADSCs within fat grafts secrete neurotrophic factors and extracellular matrix molecules that enhance nerve growth and remyelination [17]. Additionally, fat grafting has been highlighted for its mechanical and biological protective roles, creating a conducive microenvironment for nerve healing by reducing inflammation and scarring [14].

In our study, Group A (Fat Graft) also showed a significantly higher number of distal myelinated nerve axons (mean ± SD: 173.71 ± 59.32) compared to Group B (PRP) (mean ± SD: 115.86 ± 43.10; $p = 0.020$). Effective distal myelination is critical for restoring overall nerve function, as distal segments are particularly vulnerable to degeneration following injury. Similarly, the distal nerve fiber count was higher in Group A (248.21 ± 54.45) compared to Group B (192.14 ± 55.06), with a t-value of 2.7 and a p-value of 0.005, indicating enhanced distal nerve regeneration in Group A. The average axonal diameter in Group B is 0.4 ± 0.031 µm.

On the other hand, another study demonstrated that distal areas of the nerves in Group 1 (Fat Graft) contained the highest number of large myelinated axons among all the groups. The highest levels of conformational deterioration, degeneration, and blurring of axons were observed in the distal areas of the nerves in Group 2 (PRP), with a significant difference in axonal regeneration between the operated sides of Groups 1 and 2 ($p < 0.05$ and $p < 0.001$, respectively) [18].

Similarly, histomorphometric results revealed that the fat-grafted therapeutic group (Group 1) showed a significant increase in the number of regenerating nerve fibers compared to the non-fat-grafted control group (Group 2), supporting recent results reported by other studies [19, 20].

In our study, the neurotization index, which reflects the degree of nerve integration and functional recovery, was higher in Group A (Mean = 89.16) compared to Group B (Mean = 79.36; $p = 0.007$). These results suggest that fat grafting enhances nerve integration more effectively than PRP treatment. Another study reported neurotization indices of PRP-treated and untreated groups (91.9% vs. 89.5%), with statistically significant differences ($p = 0.008$) [21].

Regression analysis demonstrated a strong positive relationship between proximal and distal myelinated nerve axons in both groups. Group A (Fat Injection) exhibited a slope coefficient of 0.8455 (p-value < 0.0001), indicating a robust correlation. Group B (PRP Injection) also showed a positive relationship but with a lower slope coefficient of 0.6298 (p-value = 0.001). This stronger association in Group A suggests more consistent and predictable regeneration, likely due to the combined mechanical and biological effects of fat grafting [17].

Cherubino et al. [14].emphasized that fat grafting reduces scar formation and promotes a more favorable healing environment. By minimizing fibrosis and facilitating nerve integration, fat grafts may improve long-term

outcomes and reduce complications such as chronic pain and limited mobility.

While PRP offers growth factors that accelerate initial healing, its effects may be less pronounced over time compared to fat grafting. Nakamura et al. [15] noted that PRP primarily aids in reducing acute inflammation and promoting angiogenesis. However, its limited ability to create a sustained pro-regenerative environment may explain the comparatively lower neurotization index and axon counts observed in the PRP-treated group.

Our results were also in agreement with findings of Foda et al. [22] who investigated the efficacy of autogenous fat grafting in promoting sciatic nerve regeneration in male albino rats. Researchers created a sciatic nerve injury model and compared outcomes between rats treated with autogenous fat grafts and a control group. Histological and functional assessments revealed that the fat grafting group exhibited significant improvements in nerve regeneration, including enhanced axonal growth, reduced fibrosis, and better recovery of motor function. The findings suggested that autogenous fat grafting can serve as a promising therapeutic approach for peripheral nerve repair, potentially due to its regenerative properties and ability to provide a supportive microenvironment for nerve healing. They highlighted the potential clinical applications of fat grafting in nerve injury management.

Limitations of the current study include sample size that was relatively small, limiting the generalizability of the findings to larger populations or clinical settings. Long-term functional recovery and behavioral outcomes beyond 12 weeks were not assessed, which could provide a more comprehensive understanding of nerve repair efficacy. Further studies with larger sample sizes are recommended to confirm these findings and to explore the underlying mechanisms of autogenous fat grafting enhanced regenerative capacity. Incorporating functional assessments (such as electrophysiological studies) would provide a more comprehensive understanding of the regenerative outcomes

Conclusion

Autogenous fat grafting enhanced nerve graft regeneration compared to PRP in male albino rats. Autogenous fat grafting was associated with better outcomes in all measured parameters, suggesting it may be a more effective treatment for sciatic nerve regeneration. The higher neurotization index indicated that autogenous fat grafting not only promotes nerve fiber regeneration but also enhances graft integration and functional recovery, which is crucial for restoring nerve function.

Conflict of Interest: None

Financial Disclosures: None

REFERENCES

1. Belkas JS, Shoichet MS, Midha R. Peripheral nerve regeneration through guidance tubes. Neurol Res. 2004;26(2):151-160.
2. Zuk PA, Zhu M, Ashjian P, De Ugarte DA, Huang JI, Mizuno H, et al. Human adipose tissue is a source of multipotent stem cells. Mol Biol Cell. 2002 Dec;13(12):4279-95.
3. Marx RE. Platelet-rich plasma (PRP): what is PRP and what is not PRP? Implant Dent. 2001;10(4):225-8.
4. Lundborg G. Nerve injury and repair: regeneration, reconstruction, and cortical remodeling. J Hand Surg Am. 2004;29(2):263-4.
5. Bura-Rivière A, Sène T, et al. Animal models in peripheral nerve repair: the rat model. Ann Chir Plast Esthet. 2010;55(3):231-40.
6. Gordon T, Tyreman N, et al. Nerve regeneration and muscle reinnervation. Can J Neurol Sci. 2011;38(3):319-24.
7. Khaled MM, Ibrahium AM, Abdelgalil AI, El-Saied MA, El-Bably SH. Regenerative Strategies in Treatment of Peripheral Nerve Injuries in Different Animal Models. Tissue Eng Regen Med. 2023;20(6):839-77.
8. Zack-Williams SD, Butler PE, Kalaskar DM. Current progress in use of adipose derived stem cells in peripheral nerve regeneration. World J Stem Cells. 2015;7(1):51-64.
9. Gu X, Ding F, Yang Y, Liu J. Construction of tissue engineered nerve grafts and their application in peripheral nerve regeneration. Prog Neurobiol. 2011;93(2):204-30.
10. Tomita K, Ochi M, Tanaka N, Kudo H, Hoshino Y, Shimizu Y, et al. Enhancing nerve regeneration within a bioabsorbable polymer tube using Schwann cells and basic fibroblast growth factor. J Neurosurg. 2013;119(4):873-80.

11. Jesuraj NJ, Santosa KB, Newton P, Wood MD, Wiberg M, Terenghi G, et al. A systematic evaluation of Schwann cell injection into acellular cold-preserved nerve grafts. J Tissue Eng Regen Med. 2014;8(4):267-77.
12. Sanchez PJ, Rodriguez AV, Valverde F, Martinez J, Navarro X. Local administration of growth factors in peripheral nerve injuries. Neurosurgery. 2017;81(3):E127-35.
13. Ngeow WC. Scarless healing in oral and maxillofacial tissues: Genetic influences and cellular responses. Int J Oral Maxillofac Surg. 2010;39(7):664-78.
14. Cherubino M, Maruccia M, Pignatti M, Fleury A, Renshaw D, Gravante G. The role of fat grafting in nerve healing: A review of experimental studies. Eur J Plast Surg. 2017;40(5):345-51.
15. Nakamura T, Matsushita T, Kobayashi K, Yamashita T, Yoshioka K, Nishida K, et al. Platelet-rich plasma promotes angiogenesis and reduces inflammation in a rat model of Achilles tendon injury. J Orthop Res. 2019;37(2):317-26.
16. Masgutov R, Masgutova G, Zhuravleva M, Yashin VA, Galikhin A, Cherkashin A, et al. Adipose-derived stem cells stimulate regenerative processes in the nervous system: Experimental and clinical data. Front Neurosci. 2018;12:874.
17. Streit C, Coutinho MB, Calloni R, Bonamigo T, Silva LF, Costa L, et al. Adipose-derived stem cells and nerve regeneration: Insight into neurotrophic factor release and extracellular matrix support. J Tissue Eng Regen Med. 2019;13(6):1034-45.
18. Teymur H. The role of fat grafting in nerve regeneration: A histomorphometric and functional study. J Plast Reconstr Aesthet Surg. 2017;70(9):1275-83.
19. Tremp M, Baumgarten L, Ring A, Banic A, Constantinescu MA, Giovanoli P, et al. The influence of adipose tissue on Schwann cell proliferation and nerve regeneration. Plast Reconstr Surg. 2018;142(2):455-65.
20. Saffari A, Edalatkhah H, Mohammadi R, Moradi A, Hedayatyanfard K, Movahedi P, et al. Enhanced nerve regeneration with adipose tissue treatment: A histological and functional study. J Plast Reconstr Aesthet Surg. 2022;75(5):1129-38.
21. Elgazzar RF, Mutabagani MA, Khalifa FA, Alkhateeb MA, Ali AE, Abdulghani AA, et al. Platelet-rich plasma effects on neurotization indices: A quantitative evaluation. J Orthop Surg Res. 2008;3(1):28.
22. Foda MS, Anani RA, Mehanna AF, Orban YA. Role of autogenous fat grafting in sciatic nerve regeneration in male albino rats. Egypt J Hosp Med. 2023;91(1):4884-90.

Figure legend

Figure 1: A) Photomicrographs from proximal segment of autograft sciatic nerve treated with adipocytes, showing the descriptive lesional findings, B) Photomicrographs from distal segment of autograft sciatic nerve treated with adipocytes, showing the descriptive lesional findings, C) Photomicrographs from proximal segment of autograft sciatic nerve treated with PRP, showing the descriptive lesional findings, D) Photomicrographs from distal segment of autograft sciatic nerve treated with PRP, showing the descriptive lesional findings.

Figure (2): (A) sciatic nerve grafts were harvested & switched then nerve grafts repair were done on both sides by nylon 10/0, (B) Post-operative left sciatic nerve graft repair after 12 weeks, (C) Post-operative right sciatic nerve graft repair after 12 weeks

Citation

Azab, A., Gouda, M., Abdelaziz, N., Anani, R. Comparison Between Autogenous Fat Grafting and Platelet Rich Plasma (PRP) in Sciatic Nerve Graft Regeneration in Male Albino Rats. *Zagazig University Medical Journal*, 2025; (1635-1645): -. doi: 10.21608/zumj.2025.352947.3797