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# Accelerate the Regeneration of the Peripheral Nerve b using the Omentum in Rabbit.

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## Abstract

The regeneration in the peripheral nerve is very easy and faster than in the central nerve, therefore many researches used different methods to accelerate the nerve regeneration in the peripheral nerve.The omentum have the ability to accelerate the nerve regeneration because it reach with fatty tissue and great number of the WBC which give it the force to accelerate the regeneration in the nerve because the nature of the omentum and the fatty acid which is support it. The animals were divided to tow group the control and the treated group which used the omentum warp around the site of operation. The result showed the regeneration in the treated group were best than the control group in the SFI evaluation the treated group was the faster to reach the regeneration, the histopathological evaluation showed the regeneration in the treated group was best and faster.

**Kaywords:**-omentum, nerve regeneration, SFI,

## Introduction

The peripheral nerve injury is a real issue which lead to dysfunction and disorders in the limbs(1). The peripheral nerve suffering many types of injury including trauma lead to partial damage in the nerve or complete transaction of the nerve, the challenge of the regeneration of the nerve is vary complication(2). Many protocols were used to treatment the defect in the nerve involve stem cells, nanoparticles, suturing the two ends of the nerve and using the different materials to conduit the ends of nerve (2,3).

The degeneration of the nerve occurs in both the peripheral nervous system (PNS) and central nervous system (CNS) after axonal injury in the site of injury (distal to the site of injury) and usually begins within 24 – 36 hours of injury. Before to degeneration the distal site of the axon remains have electrically excitable. Within 72 hours axonal degeneration is followed by phagocytes of the myelin sheath by Schwann cells and clear the debris from the degeneration before the microphages inter the degeneration (4).

Regeneration is faster in the PNS, with near to complete recovery in case with lesion in distal nerve terminal. However recovery is slowly in the CNS. The difference is that in the CNS,

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myelin sheaths are produced by oligodendrocytes and not by Schwann cells. And the Schwann cells can stimulate the macrophages faster in PNS (5).

The omentum consists of a double layers of the peritoneum, the omentum descend from the greater curvature of the stomach and the proximal part of the duodenum. The lining of the omentum is composed of two layers of mesothelial cells. The "milky spots" which is rich vascular supply, trabecular connective stroma tissue contains omentum adipose cells, fibroblasts, pericytes, and leukocytes(6)

The cells of milky spots consist of the mononuclear phagocyte system which include macrophages (70%), B lymphocytes (10%), T-lymphocytes (10%), mast cells, and stromal cells. They are arranged around the omental and supported by a network of reticular fibres constitute the framework of the organ (7).

## Material and methods

Twelve healthy rabbit were used in the study. The animals were suffering to complete transaction of the Sciatic nerve in the left leg, the animals were divided in tow group the control group suturing the nerve with 0.8 nylon suture material without any addition and the treated group sutured the nerve with 0.8 nylon suture material and support with wrap of omentum was given from the same animal.

The animals were examined by using the Sciatic nerve index and the histopathological examination in 4,8 and 12 weeks to determine the regeneration of the nerve during the study.

### The Sciatic nerve index formula

$$SFI = -38.3\,[EPL-NPL/NPL] + 109.5\,[ETS-NTS/NTS] + 13.3\,[EITS-NITS/NITS] - 8.8$$

### Statistical analysis

GraphPad Prism 5 software (GraphPad Software Inc., La Jolla, USA) was used for analyzed data statistically for all the study.

### The result

**Table (1) The table showed the SFI between the control and the treated groups in the study in 4,8 and 12 weeks.**

| Groups | Sciatic nerve index formula |
|---|---|

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| | 4 W | 8W | 12 W |
|---|---|---|---|
| C G | -130.1 ± 0.29 | -116.5 ±0.32 | -76.1 ±0.77 |
| T G | -129.5± 0.76 | -102.2 ± 0.44 | -62.12 ±2.76 |

The result of the SFI showed the control and the treated group have the same result in the 4 and the 8 weeks, and the treated group have the deferent result and the treated group were best than the control group.In the 12$^{th}$ week the treated group give the best result comparative with the control group.

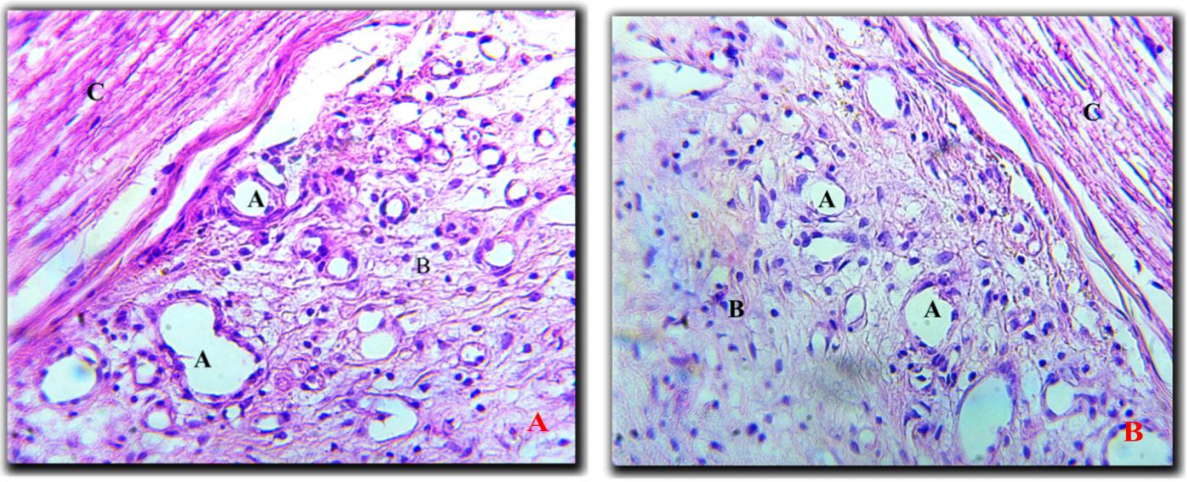


**Figure (1) this figure showed the result of the histopathological examination of the Sciatic nerve of rabbit distal stump during the first week. (A) showed the control in 4 week (a) the degenerative vacuoles in the distal stump, (b) the inflammatory cells (c) the nerve fibers.**

**(B) showed the treated group in 4 week (a) the degenerative vacuoles in the distal stump, (b) the inflammatory cells (c) the nerve fibers.**

The result of the 4$^{th}$ weeks of the Sciatic nerve in the control group and treated group the fragment of the nerve fibers were present and the degenerative vacuoles were present and clear in all the section, this referee to the degenerative proses which happened after the nerve trauma or nerve injury. The inflammatory cells were present in the sit (fig 1).

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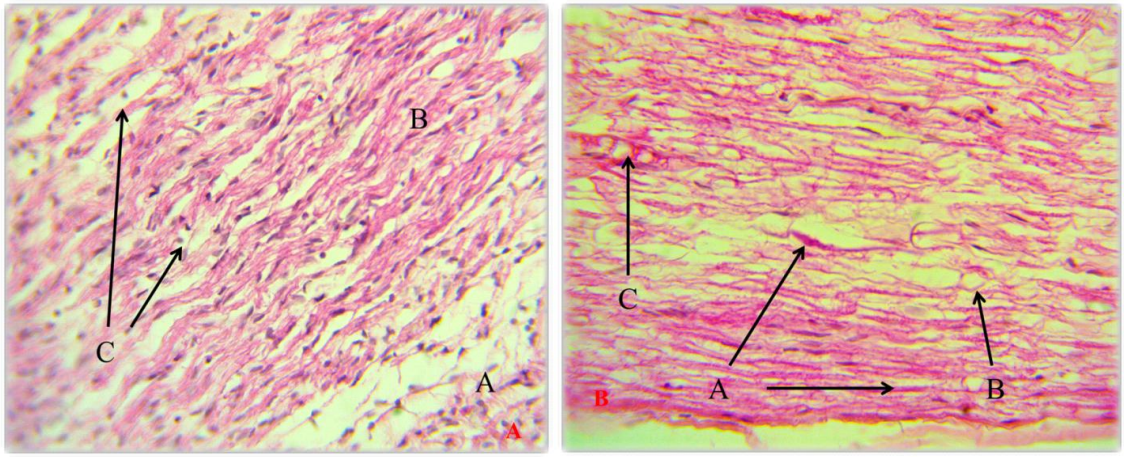


**Figure (2) this figure showed the result of the histopathological examination of the Sciatic nerve of rabbit distal stump during the 8th weeks. (A) showed the control in 4 week (a) the degenerative vacuoles in the distal stump with fragment of nerve , (b) the nerve fibers, (c) the inflammatory cell.**

**(B) showed the treated group in 8 week (a)the axon of the nerve fibers, (b) degenerative vacuoles (c) Node of Ranvier.**

In the 8th weeks the nerve in control group appear a wavy shape and there is many fragments of the nerve fibers in the section, the degenerative vacuoles were present with many of the inflammatory cells in the section. In the treated group the nerve fibers were arranged in parallel with present of small amount of the degenerative vacuoles, the axons were present in many sits in the section and the node of Ranvier were present and clearly(fig2).

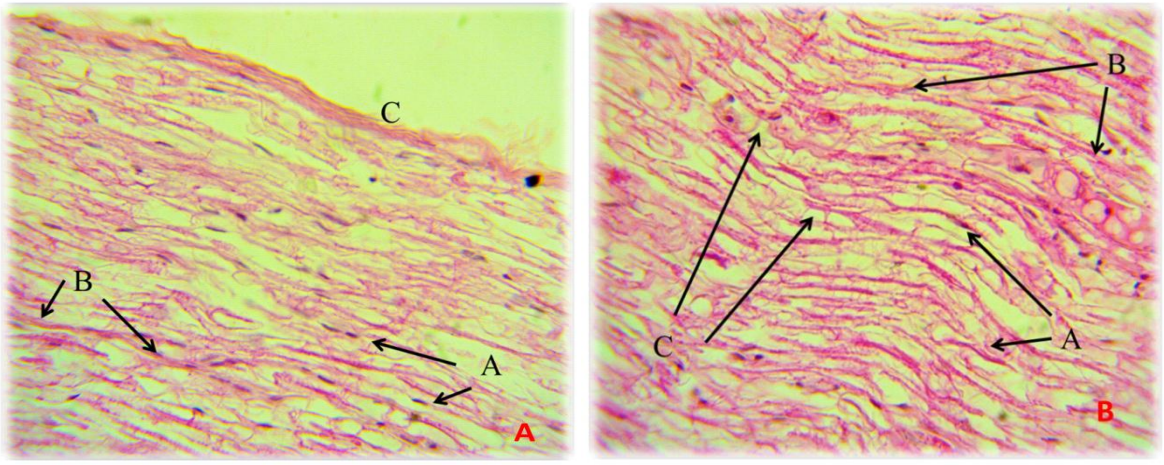


**Figure (3) this figure showed the result of the histopathological examination of the Sciatic nerve of rabbit distal stump during the 12 weeks. (A) showed the control in 12 weeks (a) the Schwann cells, (b) the nerve fibers, (c) the epinurume.**

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**(B) showed the treated group in 8 week (a) Schwann cells, (b) the axon and the nerve fibers, (c) Node of Ranvier.**

In the 12th weeks in the control group there are small numbers of the degenerative vacuoles were present and the Schwann cells with node of Ranvier were present. In the treated group the nerve fibers were arranged in parallel and good arrangement, the axons of the nerve good appearance and the the Schwann cells were present with node od Ranvier(fig 3).

## Discussion

In the result of the Sciatic index formula the best and the regeneration proses were for the treated group which were added the omentum to the site of operation, this result agree with (1) when he work at Rosuvastatin enhanced functional recovery after sciatic nerve injury in the rat and he found The SFI values at 2, 4 and 6 weeks after surgery increased significantly in all groups with a significant difference between rosuvastatin treatment groups. And our study agreed with (8) his work was about Neuroprotective Effect of NypafruticansWurmb by Suppressing TRPV1 Following Sciatic Nerve Crush Injury in a Rat, he found the treated group was the best comparative with the control group in all the time.

In the histopathological examination our study agreed with (9) when her work at The longitudinal epineural incision and complete nerve transection method for modeling sciatic nerve injury, and examined the epineurium recovery after nerve transition at 2nd and 4th weeks post-surgery, showed distinct Wallerian degeneration, consider- able inflammatory cell infiltration, demyelination and vacuolation were present in nerve fibers and the outer myelin sheath. And agreed with (10) his study about The repair Schwann cell and its function in regenerating nerves,

(11) found in his work, free omental grafts have shown a high survival rate and have enhanced revascularisation of the nerve graft. The higher vascular perfusion may be responsible for less fibrosis, and support axonal regeneration that agreed with our study. And (12) was agreed too when he found Many factors influence results, including the type of injury, axonalmisdirection and perhaps compromised revascularization with subsequent fibrosis.

And this present study agreed with (13) when his study about Effect of Local Delivery of GDNF Conjugated Iron Oxide Nanoparticles on Nerve Regeneration along Long Chitosan Nerve Guide, he found the nanoparticles accelerate the nerve regeneration comparative with the control group. Our study is agreed with (14) they found the Mg groups which were different types of materials with the Mg and comparative with control group, the best result were recording to the Mg groups, they refer to the Mg+ which was released in the site of injury and accelerated the nerve regeneration and help to increase the numbers of Schwann cells and the microphages in the site of injury when they used the magnesium filaments nerve conduit. This study agreed with (15) they found in 8th weeks deferent changes between the treated groups and the control groups when they used allograft to treatment the Sciatic nerve injury in Functional, Histopathological and

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## Conclusion

Our conclusion of this study that used of the omentum was very useful and give good result in the regeneration of the peripheral nerve and accelerated the nerve proses degeneration and regeneration and lead to accelerate the nerve healing.

## Limitations and Future Studies

This research was special exertion

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## References

1. Abdolmaleki, A., Zahri, S., Bayrami, A., Rosuvastatin enhanced functional recovery after sciatic nerve injury in the rat, *European Journal of Pharmacology* (2020)
2. Tajdaran, K., Chan, K., Shoichet, M.S., Gordon, T., Borschel, G.H.,. Local delivery of FK506 to injured peripheral nerve enhances axon regeneration after surgical nerve repair in rats. Actabiomaterialia 2019.
3. Hüseyinoğlu, N., Özaydın, İ., Yayla, S., Yıldırım, C., Aksoy, Ö., Kaya, M., Şengöz, A., Taşdemiroğlu, E. Electrophysiological assessment of the effects of silicone tubes and hyaluronic acid on nerve regeneration in rats with sciatic neurorrhaphy. KafkasUniv Vet Fak 2012.
4. GILLEY, Jonathan; COLEMAN, Michael P. Endogenous Nmnat2 is an essential survival factor for maintenance of healthy axons. PLoS biology, 2010, 8.1: e1000300.
5. Taylor, C.A.; Braza, D.; Dillingham, T.; Rice, J.B. The incidence of peripheral nerve injury in extremity trauma. Am. J. Phys. Med. Rehabil. 2008, 87, 381–385.
6. Collins, D.; Hogan, A.M.; O'Shea, D.; Winter, D.C. The omentum: Anatomical, metabolic, and surgical aspects. J. Gastrointest. Surg. 2009, 13, 1138–1146
7. Dujovny, M.; Ding, Y.H.; Ding, Y.; Agner, C.; Perez-Arjona, E. Current concepts on the expression of neurotrophins in the greater omentum. Neurol. Res. 2004, 26, 226–229
8. Kang, M. S., Lee, G. H., Choi, G. E., Yoon, H. G., & Hyun, K. Y. Neuroprotective Effect of NypafruticansWurmb by Suppressing TRPV1 Following Sciatic Nerve Crush Injury in a Rat. *Nutrients*, (2020). *12*(9), 2618.
9. Cheng , X.; Wang, P.; Sun, B.; Liu, S.; Gao, Y. ; He, X. & Yu, C. The longitudinal epineural incision and complete nerve transection method for modeling sciatic nerve injury. Neural regeneration research, (2015). 10(10), 1663.

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Received 08 November 2021; Accepted 15 December 2021.

10. Jessen, K. &Mirsky, R. The repair Schwann cell and its function in regenerating nerves. Journal of physiolog, (2016). 594(13): 3521-3531.
11. CHAMORRO and Manuel,. The effect of omental wrapping on nerve graft regeneration. British journal of plastic surgery, 1993, 46.5: 426-429.
12. Restrepo Y, Merle M, Michon J, Folliguet B, Barrat E. Free vascularized nerve grafts. An experimental study in the rabbit. Microsurgery 1985; 6: 7884.
13. Federica Fregnan, MichelaMorano, OfraZiv-Polat, Mira M. Mandelbaum-Livnat, Moshe Nissan, Tolmasov Michael, AkivaKoren, TaliBiran, YifatBitan, EvgeniyReider, Mara Almog, NicolettaViano, Shimon Rochkind, Stefano Geuna and Abraham Shahar,. Effect of Local Delivery of GDNF Conjugated Iron Oxide Nanoparticles on Nerve Regeneration along Long Chitosan Nerve Guide. March 14th 2017Published: May 31st 2017
14. Vennemeyer JJ, Hopkins T, Hershcovitch M, KD Little, MC Hagen, D Minteer, DB Hom, K Marra, and SK Pixley. Initial observations on using magnesium metal in peripheral nerve repair. J Biomater Appl. 2015 March ; 29(8): 1145–1154. doi:10.1177/0885328214553135.
15. Amir Amniattalab, and Rahim Mohammadi, 2017. Functional, Histopathological and Immunohistichemical Assessments of Cyclosporine A on Sciatic Nerve Regeneration Using Allografts: A Rat Sciatic Nerve Model, Bull Emergency Trauma. 2017 Jul; 5(3):152–159.