بسم الله الرحمن الرحيم

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شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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The Potential Role of Human Derived Amniotic Membrane Graft in the Repair of Induced Tendon Tear in Adult Male Albino Rat: Histological Study

Thesis

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Dalia Ahmed Yousef Yehia

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List of Abbreviations

Abb.	Full term
AF	*Amnoitc fluid*
AM	*Amniotic membrane*
ATRS	*Achilles Tendon Rupture Score*
b-FGF	*Basic-fibroblast growth factor*
BFSCs	*Buccal fat pad-derived stem cells*
BM	*Basement membrane*
BMI	*Body mass index*
BM-MSCs	*Bone marrow mesenchymal stromal cells*
BMS	*Bristol Mayers Squibb*
CCL-2	*Chemokine ligand-2*
CL	*Compact layer*
CS	*Collagen scaffolds*
DAB	*Diaminobenzidine*
dACMs	*Dehydrated amnion/chorion membranes*
DMEM	*Dulbecco's modified Eagle's medium*
ECM	*Extra cellular matrix*
EDGF	*Epidermal derived growth factor*
EGFr	*Epidermal growth factor receptor*
ESCs	*Embryonic stem cells*
hAECs	*Human amniotic epithelial cells*
hAM	*Human Amniotic Membrane*
hAMSCL	*Human amniotic mesenchymal stromal cells layer*
hAMSCs	*Human amniotic mesenchymal stromal cells*
HGF	*Hepatocyte growth factor*
HIF-1	*Hypoxia inducible factor-1*
HIV-I	*Human Immunodeficiency Virus-1*

List of Abbreviations cont...

Abb.	Full term
HLA	*Human leukocyte antigen*
HLA-G	*Human leukocyte antigen G*
IFGF-1	*Insuline like growth factor 1*
KGF	*Keratinocyte growth factor*
MASRI	*Medical Research Center, Ain Shams University*
MMPs	*Matrix metalloproteinases*
MSCs	*Mesenchymal stem cells*
NGF	*Nidogen growth factor*
PBS	*Phosphate buffered saline*
PDGF	*Platelet derived growth factor*
PRF	*Platelet Rich Fibrin*
PRP	*Platelet Rich Plasma*
RCMB	*Regional Center for Mycology and Biotechnology*
SCX	*Scleraxis*
SL	*Spongy layer*
SPSS	*Statistical Package for the Social Sciences*
TEM	*Transmission Electron Microscope*
TGF-β	*Transforming growth factor-beta*
TSPCs	*Tendon stem/progenitor cells*
VEGF	*Vascular Endothelial Growth Factor*
WBCs	*White blood cells*

ABSTRACT

The Potential Role of Human Derived Amniotic Membrane Graft in the Repair of Induced Tendon Tear in Adult Male Albino Rat: Histological Study

Introduction: Achilles tendon injuries cause severe impairment in patient mobility and productivity. Tendon tears are still among the challenges to treat in medicine. Continuous efforts are still needed to enhance the effectiveness of the treatments and to accelerate recovery to the normal biochemical properties of the tendon. Amniotic membrane (AM) showed many characteristics that renders it a promising natural therapeutic alternative for tendon tears.

Aim: The aim of the study was to investigate the effect of human amniotic membrane graft application on the repair of induced Achilles tendon tear.

Material and methods: Fresh amniotic membrane grafts were prepared from harvested human full-term caesarian sections-delivered placentas. Forty-two adult male albino rats were divided into three groups; group I (control group) (n=12), group II (tendon tear untreated group) (n=15) in which a full thickness incision was induced in the Achilles tendons and group III (AM treated group) (n=15). In which after induction of tear as in group II, amniotic membrane graft was applied circumferentially on the tendon tear. Rats were sacrificed after 3, 14 and 28 days.

Results: After the induced tear, the untreated group II showed large areas of heavy mononuclear cellular infiltration, significant decrease in collagen fibril diameter and mean collagen area percentage with evident accumulation of fat cells. Significant increase in area percentage and optical density of the immune reaction for vascular endothelial growth factor (VEGF) was also noticed. Along the course of the experiment, the AM-treated group showed significant increase in the collagen area percentage and fibril diameter compared to group II. Also, it showed significant increase in tenocytes count at 3 and 14 days with apparent relative decrease in the mononuclear inflammatory cells compared to group II. At 28 days it showed non-significant difference in collagen fibril diameter, mean collagen area percentage, VEGF area percentage and VEGF optical density compared to the control group.

Conclusion: It was concluded that the application of human amniotic membrane grafts in the repair of induced Achilles tendon tear in rat was effective.

Keywords: Amniotic Membrane, Achilles Tendon, Tendon Tears, VEGF, Collagen.

INTRODUCTION

Tendon injuries are one of the most common injuries occurring to the human body. These injuries are responsible for large health care costs, lost work time and individual morbidity **(Dunning *et al*., 2010)**. Achilles tendon is the largest tendon in the body and is the most affected by many pathological and traumatic injuries. These injuries are more specifically common among athletes, however, there is an increase in tendon injuries incidence among all population age groups due to the increase in physical activities **(de Jonge *et al*., 2011).**

Tendon's structural and functional healing properties are usually suboptimal when compared to healthy tendon tissue **(Aspenberg, 2007).** Its natural healing potential is extremely low and inefficient, with significant dysfunction and disability due to hypocellularity and hypovascularity of tendon tissues **(Hsieh *et al*., 2016).**

Many previous studies done on both animal and patients, showed various therapeutic approaches. These included nitric oxides patches, anti-inflammatory drugs (steroids and non-steroids), eccentric exercises, ultrasound, and laser **(Andres and Murrell, 2008).** However, the quality of tendon repair currently does not meet the clinical needs in tissue regeneration and pain reduction **(Nicodemo *et al*., 2017).**

Recently, studies are investigating enhancing tendon repair by biological methods. These included applying growth factors, stem cells, and biomaterials, alone or cell-loaded, at the site of tendon damage **(Docheva *et al*., 2015).** In line with these recent strategies, the human amniotic membrane (hAM) has gained attention because of its ability to modulate adult wound healing. It is the innermost layer of the fetal membranes, which is usually discarded after birth as a part of the placenta. It was demonstrated that hAM has the ability of promoting healing while suppressing inflammation and scarring. Additionally, human amniotic membrane has an advantage that it can be easily obtained, processed, transported, and stored without ethical concerns **(Niknejad *et al*., 2008).**

Currently, Amniotic membrane (AM) proved to have two main characteristics, their ability to modulate and suppress immunity and their differentiation capacity. Thus, hAM offer a source of scaffolds and cells for tissue engineering that is necessary to create an optimal environment for cell and tissue regeneration **(Wassmer and Berishvili, 2020).**