FACIAL CELL ASSISTED LIPOGRAFT COMPARING MECHANICAL AND ENZYMATIC PREPARATION OF THE STROMAL VASCULAR FACTOR: A COMPARATIVE STUDY

Thesis

Submitted By

Aly Hussein Saber Abulhassan M.B.B.Ch, M.S.C (Alexandria University)

Submitted For Partial Fulfillment of Doctor Degree

In Plastic and Reconstructive Surgery

Supervisors

Prof. Dr. Ahmed Adel Noureldin

Professor of Plastic and Reconstructive Surgery Faculty of Medicine Cairo University

Prof. Dr. Maamoun Ismail Maamoun

Professor of Plastic and Reconstructive Surgery Faculty of Medicine Cairo University

Prof.Dr. Lobna Yousef Ghanem

Professor of Clinical Pathology Theodor Bilharz Institute

> Faculty of Medicine Cairo University 2015

مقارنة بين التحضير الميكانيكي والإنزيمي للعوامل الدموية اللحمية لحقن الدهون بالخلايا الوجهية

رسالة مقدمة من الطبيب / على حسين صابر أبوالحسن بكالوريوس الطب والجراحة – جامعة الإسكندرية توطئة للحصول على درجة الدكتوراه في جراحة التجميل وعلاج الحروق

تحت إشراف أ.د / أحمد عادل نور الدين أستاذ جراحة التجميل كلية الطب – جامعة القاهرة

أ. د / مأمون إسماعيل مأمون

أستاذ جراحة التجميل كلية الطب – جامعة القاهرة

أ.د/ لبنى يوسف غانم

أستاذ الباثولوجيا الإكلينيكية معهد تيودور بلهارس

> كلية الطب جامعة القاهرة ٢٠١٥

Acknowledgment

First of all I thank Allah for helping me to accomplish this research and for providing me with such very encouraging and supportive supervisors.

I wish to express my deepest gratitude to **Prof. Dr. Ahmed Adel Noureldin,** Professor of Plastic and Reconstructive Surgery, Faculty of Medicine, Cairo University, who suggested this topic and supervised this work. I appreciate his close enthusiastic co-operation and advise as well as his generous efforts in the evaluation of this work.

I would like to express my greatest gratitude to **Prof. Dr. Maamoun Ismail Maamoun,** Professor of Plastic and Reconstructive Surgery, Faculty of Medicine, Cairo University, for his valuable advice, fruitful suggestions and continuos encouragement as well as his generous efforts in the evaluation of this work.

I would like to express my deep appreciation to **Prof. Dr. Lobna Yousef Ghanem,** Professor of Clinical Pathology, Theodor Bilharz Institute, for her continuos help, valuable advice and support.

I'm also grateful to all staff member and colleagues in Cairo Plastic and Reconstructive Surgery Department for their helpful Cooperation.

To my father

&

My mother and to my family

Abstract

For more than a century, clinicians have attempted to use

fat for the treatment of tissue deficiencies and contour abnormalities with variable outcome and fate of the transferred fat.

Autologous fat transfer for facial contouring has become popular in plastic surgery only in the past 20 years.In fact, surgeons have understood that ageing of the face is not attributable to gravity-induced ptosis alone, but is also a consequence of volume loss caused by tissue atrophy. Thus, volume replacement using fat transfer is the aim of the hereby presented treatment.

The aim of this study is to evaluate the effect of two types of isolation of lipograft in the face and their persistence and the changes they will produce.

This study was conducted on 50 patients

complaining of facial ageing and facial scars whether

post traumatic or post burn from the period between

January 2013 and December 2014

The sample population was divided into two groups:

Group A underwent fat processing using the <u>mechanical mesh/gauze</u> to separate the SVF (39 patients) in order to obtain micro and nanofat grafts.

Group B underwent fat processing using the <u>enzymatic /collagenase</u> technique to separate the SVF

(11 patients).

The techniques of fat processing both the mechanical and enzymatic techniques have demonstrated valuable clinical outcomes in all indications. Although the enzymatic technique demonstrated valuable results in concentrating the ADSC's with less need for secondary retouches.

Key words

Facial Cell Assisted Lipograft Comparing Mechanical And Enzymatic Preparation Of The Stromal Vascular Factor: A Comparative Study

LIST OF CONTENTS

Chap	ter Pa	age
ACKN	NOWLEDGMENT	i
LIST	OF CONTENTS	ii
LIST	OF TABLES	. iii
LIST	OF FIGURES	iv
LIST	OF ABBREVIATIONS	vi
I.	INTRODUCTION	1
II.	AIM OF THE WORK	3
III.	REVIEW	4
IV.	MATERIALS AND METHODS	. 64
V.	RESULTS	.76
VI.	CLINICAL CASES	. 87
VII.	DISCUSSION	106
VIII.	SUMMARY	118
IX.	CONCLUSION	120
X.	REFERENCES	121
	PROTOCOL	
	ARABIC SUMMARY	

LIST OF TABLES

Table		page
(1)	Fat characteristics	26
(2)	Needle size and cell survival	27
(3)	Comparison between two studied groups according to demographic data	76
(4)	Comparison between two studied groups according to site of aspiration and type of fat	78
(5)	Comparison between two studied groups according to amount of fat aspirated and injected	79
(6)	Comparison between two studied groups according to second touch up and PT/PB/ Rejuvenatation	81
(7)	Statistical analysis of the studied cases according to Amount of fat aspirated and injected	83
(8)	Correlation between age with Amount of fat aspirated and injected	84
(9)	Distribution of the studied cases according to complications	85
(10)	Number of cells in different sample sites /5ml	86
(11)	Assessment of results using 3D digital camera	86
(12)	Results of the cell count from the three single fat samples	114

LIST OF FIGURES

Figure		page
(1)	Attenuated ligaments in the midface	17
(2)	Showing the different ligaments and tissue condensations between fat groups	18
(3)	Showing the SOOF compartments	20
(4)	The buccal fat pad and its extensions	21
(5)	Stored calories are in two forms	24
(6)	The yo-yo hyperglycemia experienced by refined carb carboholics	24
(7)	Coleman aspiration cannula	29
(8)	The layers of the sedimented fat	29
(9)	A 3mm multi-hole cannula with 1mm side holes	30
(10)	Centrifugation	33
(11)	Sedimentation	35
(12)	Different methods large volume fat grafting	39
(13)	Blastocyst and embryonic stem cells	45
(14)	Adult Cells Are Found Throughout Every Major Tissue And Organ System In The Human Body And Are Involved In The Continual Renewal Of The Tissues That They Inhabit	48
(15)	Adipose-derived stem cells	52
(16)	Cell-Assisted Lipotransfer (CAL).	57
(17)	Comparing mesenchymal stem cell isolation by mechanic and enzymaticmethods	60
(18)	The harvesting cannula consists of a multiport sharp cannula	67
(19)	A sterile canister with a 0.5-mm mesh cloth is used to rinse the fat with a sterile normal saline solution	69
(20)	Showing the fat transferred to sterile syringes	69
(21)	Fat is then transferred to 1cc or 3cc sterile syringes using a female to female leur lock connector	70

Figure		page
(22)	Mechanical emulsification of microfat graft to yield nanofat graft	71
(23)	Mixture incubated in a culture flask in a gyratory shaker bath	72
(24)	Showing DMEM (Dulbeccos Modified Eagle Medium)	73
(25)	Comparison between two studied groups according to sex	77
(26)	Comparison between two studied groups according to age	77
(27)	Comparison between two studied groups according to site of aspiration	78
(28)	Comparison between two studied groups according to amount of fat aspirated	80
(29)	Comparison between two studied groups according to amount of fat injected	80
(30)	Comparison between two studied groups according to second touch up and PT/PB/ Rejuvenatation	82
(31)	Distribution of the studied cases according to additional technique	82
(32)	Correlation between amounts of fat injected with amount of fat aspirated	83
(33)	Correlation between age with amount of fat injected	84
(34)	Distribution of the studied cases according to complications	85
(35)	Radius of the fat particles	109

LIST OF ABBREVIATION

stem
ng

INTRODUCTION

For more than a century, clinicians have attempted to use fat for the treatment of tissue deficiencies and contour abnormalities with variable outcome and fate of the transferred fat.

Autologous fat transplantation has been used to correct subcutaneous lipoatrophy resulting from acne, trauma, lipodystrophy, hemifacial atrophy, cutaneous lupus erythematosus, and scleroderma and defects resulting from accidents, infections, or surgery. While autologous fat transfer for facial contouring has become popular in plastic surgery only in the past 20 years.

In fact, surgeons have understood that ageing of the face is not attributable to gravity-induced ptosis alone, but is also a consequence of volume loss caused by tissue atrophy. Thus, volume replacement is the aim of the hereby presented treatment. The use of adipose tissue for this purpose has become the preferred option, as it is readily available, inexpensive, hostcompatible, and can be harvested easily and repeatedly when needed, without fear of allergies or foreign body reactions.

Despite clinical optimism associated with autologous fat transfer, uncertainty remains among practitioners regarding the viability of transplanted fat. There is no set way of processing fat to ensure the graft's viability and optimal take, although various preparation techniques have been suggested for improving the long-term survival of fat grafts.

Suggested "cleansing" procedures have included centrifugation, simple decantation, vigorous washing, no washing at all, dense-cloth fat concentration and enzymatic separation of ADSC.

1

The commonly used method of ADSC is the enzymatic digestion of the lipoaspirate .Although the major difference from the enzymatic technique, the ease of the mechanical separation of the ADSC made the technique more popular.

To improve the end results; harvest and re-injection techniques have been recently refined. In addition the concomitant use of autologous stem cells and the stromal vascular fraction (SVF) has been proposed as an adjunct to improve the amount of retained fat.

In this study we will utilize both the mechanical and enzymatic separation of the SVF with recent refinement of both techniques in order to compare the clinical outcome of each method.

AIM OF WORK

The aim of this study is to evaluate the effect of two types of isolation of lipograft in the face and their persistence and the changes they will produce.