

**Repair of alveolar cleft defects using bone  
marrow aspirate in a resorbable matrix  
( clinical and radiographic study )**

**Thesis**

**Submitted to the Faculty of Oral and Dental  
Medicine, Cairo University for partial fulfillment  
of the requirements of Doctorate Degree in Oral  
and Maxillofacial Surgery**

**By**

**Hesham Fattouh Abd-Allah Ramadan  
B.D.S. 2003, MSc. 2009  
(Cairo University)**

*Assistant Lecturer  
Oral and Maxillofacial Surgery Department  
Faculty of Oral and Dental Medicine  
Cairo University  
2013*

# *Supervisors*

## **Dr. Ragia M. Mounir**

Professor and Head of *Oral and Maxillofacial  
Surgery Department*  
Faculty of Oral and Dental Medicine  
Cairo University

## **Dr. Mamdouh Abulhassan**

Professor of Pediatric Plastic Surgery  
Faculty of Dental Medicine  
Cairo University

## **Dr. Hassan Abdelghany**

Lecturer of Oral and Maxillofacial Surgery  
Department  
Faculty of Oral and Dental Medicine  
Cairo University

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

" وَ قُلْ رَبِّ زِدْنِي عِلْمًا "

صدق الله العظيم

سورة طه ( 114 )

# *Dedication*

## DEDICATION

*TO:*

*The Soul Of My Father...*

*My great Mother, Sister and Brother ...*

*My sacrificing wife.....*

*And my beloved daughter Joudy.*

# *Acknowledgement*

## *ACKNOWLEDGEMENT*

*Before and above all, I would like to thank ALLAH for supporting and guiding me throughout the whole of my life.*

*I was fortunate to conduct this work under the supervision of Prof. Dr Ragia M. Mounir, Professor and Head of Oral and Maxillofacial Surgery Department, Faculty of Oral and Dental Medicine, Cairo University. I would like to express my sincere appreciation and gratitude for her patience, kindness, unlimited support and valuable guidance. It was a great honor to work under her meticulous supervision.*

*I wish to express my deep gratitude to Prof.Dr. Mamdouh Abulhassan Professor of Pediatric Plastic Surgery, Faculty of Dental Medicine, Cairo University for his powerful support and guidance during all the steps of this work.*

*I would like to thank Dr. Hassan Abdelghany, Lecturer of Oral and Maxillofacial Surgery, Faculty of Oral and Dental Medicine, Cairo University for his valuable advice and sincere tolerance, cooperation and continuous encouragement throughout this work.*

*I would like to express my sincere appreciation to all the staff members and all my colleagues in the Oral and Maxillofacial Surgery department, Faculty of Oral and Dental Medicine, Cairo University for their unlimited support and valuable advices throughout all the steps of this work.*

*Of course I am indebted to the patients and the volunteers who accepted to be a part of this study. I sincerely hope that this work would provide benefit to them.*



# **List of Contents**

	<b>Page</b>
<b>Introduction</b>	<b>1</b>
<b>Review of Literature</b>	<b>3</b>
<b>Aim of the Study</b>	<b>35</b>
<b>Patients and Methods</b>	<b>36</b>
<b>Results</b>	<b>66</b>
<b>Discussion</b>	<b>93</b>
<b>Summary &amp; Conclusion</b>	<b>102</b>
<b>References</b>	<b>105</b>
<b>Arabic Summary</b>	<b>121</b>

# **List of Figures**

<b>Figure no.</b>	<b>Title</b>	<b>Page</b>
<b>Fig. (1)</b>	<i>showing Common flap design used for alveolar cleft repair.</i>	10
<b>Fig. (2 to 5)</b>	<i>showing preoperative patient photograph from different views.</i>	39
<b>Fig.(6 &amp; 7)</b>	<i>showing preoperative alveolar cleft defect .</i>	40
<b>Fig. (8)</b>	showing alveolar cleft defect in axial cut.	40
<b>Fig. (9)</b>	showing alveolar cleft defect in coronal cut.	40
<b>Fig. (10)</b>	showing reformatted Panoramic image obtained from CBCT.	41
<b>Fig. (11)</b>	showing cleft defect in 3d image.	41
<b>Fig. (12)</b>	<i>photograph showing palatal expansion device.</i>	42
<b>Fig. (13)</b>	<i>Showing alveolar cleft flap incision &amp; reflection.</i>	45
<b>Fig. (14 &amp;15)</b>	<i>showing suturing nasal floor using 4-0 vicryl suture .</i>	45
<b>Fig. (16)</b>	<i>showing diagrammatic representation for the treatment plan of the control group.</i>	46

<b>Fig. (17)</b>	<i>showing iliac crest incision and reflection</i>	47
<b>Fig. (18)</b>	showing exposure of iliac crest.	49
<b>Fig. (19)</b>	showing measuring the desired cortical bone.	49
<b>Fig. (20)</b>	showing cutting and removing cortical bone.	49
<b>Fig. (21&amp;22)</b>	showing preparation of the harvested cortical and cancelous bone to fit the cleft site.	50
<b>Fig. (23&amp;24)</b>	showing adjusting the cortical bone and filling of the cancelous bone to the defect site.	50
<b>Fig. (25)</b>	<i>showing diagrmatic representation for the treatment plan of the study group.</i>	51
<b>Fig. (26)</b>	<i>showing bone marrow aspirating syringe with its stilette.</i>	52
<b>Fig. (27)</b>	<i>showing aspirated bone marrow in heparinised plastic syringe.</i>	52
<b>Fig. (28 &amp; 29)</b>	<i>showing diagrmatic representation for point of needle entry.</i>	53
<b>Fig. (30 &amp; 31)</b>	<i>showing advancemet of the trocar and aspiration of the bone marrow.</i>	53
<b>Fig. (32)</b>	showing dry collagen carrier.	55
<b>Fig. (33&amp;34)</b>	showing collagen carrier after being soaked with the bone marrow aspirate.	55
<b>Fig. (35&amp;36)</b>	showing application of the collagen with the aspirate to the cleft site.	56
<b>Fig.(37&amp;38)</b>	showing collagen soaked with the aspirate at the cleft site	56

<b>Fig. (39)</b>	showing stitching cleft site (patient from control group).	57
<b>Fig. (40)</b>	showing stitching cleft site (patient from study group).	57
<b>Fig. (41)</b>	<i>showing VAS used for pain assessment in our study.</i>	60
<b>Fig. (42)</b>	<i>showing volume calculation using CBCT.</i>	62
<b>Fig. (43)</b>	<i>showing schematic representation of alveolar bone height</i>	64
<b>Fig. (44&amp;45)</b>	showing pre and postoperative alveolar cleft healing after grafting with iliac crest (group A).	69
<b>Fig. (46)</b>	showing iliac crest wound in 1 week follow up after stitch removal (group A).	69
<b>Fig. (47&amp;48)</b>	showing postoperative alveolar cleft healing after 1 week & 6 months with the bone marrow aspirate (group B)	70
<b>Fig. (49)</b>	showing trocar indentation and skin erythema after 1 day in patient of group B.	70
<b>Fig. (50)</b>	Failure of the grafting procedure in a patient of the control group (with the arrow pointing to the exposed graft).	72
<b>Fig. (51 &amp; 52)</b>	showing preoperative CBCT of a patient from the control group	82
<b>Fig. (53 &amp; 54)</b>	showing postoperative bone formation at the end of the follow-up period (6 months) of the same patient	82
<b>Fig. (55 &amp; 56)</b>	showing preoperative radiograph of a patient from the study group.	83
<b>Fig.</b>	showing postoperative radiograph with new bone formation at the	83

<b>(57 &amp; 58)</b>	end of the follow-up period (6 months) of the same patient of the study group.	
----------------------	--	--

# **List of Tables**

<b>Table</b>	<b>Title</b>	<b>Page</b>
<b>Table (1)</b>	Demographic character of group A.	66
<b>Table (2)</b>	Demographic character of group B.	67
<b>Table (3)</b>	Number and percentage of patients with disturbed healing process and significance of the difference using Chi Square test.	72
<b>Table (4)</b>	Number and percentage of patients with disturbed gait and significance of the difference using Chi Square test.	74
<b>Table (5)</b>	Number and percentage of patients with problematic scarring and significance of the difference using Chi Square test.	75
<b>Table (6)</b>	Number and percentage of patients with sensory disturbance and significance of the difference using Chi Square test.	76

<b>Table (7)</b>	Pain scores (Mean±SD) over time on the VAS (out of 10) and significance of the difference using unpaired Student's t test	78
<b>Table (8)</b>	Number (percentage) of patient acquiring pain over time (6 patients) and significance of the difference using Chi Square test.	79
<b>Table (9)</b>	Number and percentage of cases showing bone formation bridging the gap and significance of the difference using Chi Square test.	80
<b>Table (10)</b>	Mean preoperative volume, mean percentage of bone fill and volume of bone fill in Group A.	84
<b>Table (11)</b>	Mean preoperative volume, mean percentage of bone fill and volume of bone fill in Group B.	85
<b>Table (12)</b>	Preoperative bone volume (cc) in both groups and statistical significance of the difference (Unpaired Student's t test).	85
<b>Table (13)</b>	Percentage of bone fill in both groups and statistical significance of the difference (Unpaired Student's t test).	86
<b>Table (14)</b>	Post-operative bone fill volume (cc) in both groups and statistical significance of the difference (Unpaired Student's t test).	87
<b>Table (15)</b>	Mean bone density in both groups 6 months post-operatively and statistical significance of the	89