

**The Use of Composite of Bone Marrow
Concentrate and Alloplast in Reconstruction of
Residual Surgical Defects: A Radiographic and
Histological study**

*A PhD thesis Submitted to the Faculty of Dentistry, Ain Shams University for
partial fulfillment of the requirements of doctoral degree in Oral and
Maxillofacial Surgery*

Presented by

Mahmoud Abdel Aziz Mostafa El Fadly

B.D.S. 2006

M.SC. 2014

Supervisors

Dr. Salah Abdel Fattah Ahmed

Professor of Oral and maxillofacial surgery
Faculty of Dentistry, Ain-shams University

Dr. Heba Abdel Wahed Abdel Hafez

Assistant professor of Oral and maxillofacial surgery
Faculty of Dentistry, Ain-shams University

Faculty of Dentistry
Ain-Shams University
2018

Dedication

This work is dedicated to

My Dear parents

The light that leads my way

My beloved wife, son and daughter

My true friends and colleagues for their
encouragement and cooperation

Acknowledgment

I would like to express my special thanks and
gratitude to **Yasser El Hadidi**

*Asst. lecturer of Oral and Maxillofacial Surgery
Faculty of Dentistry, Ain shams university*

For his effort and unlimited willingness for help.

I would also like to express my deep gratitude to

Dr. Fatma Badawi

*Lecturer in Oral Radiology department Faculty of
Dentistry, Ain Shams University*

Hossam Hany

*Resident of Oral and Maxillofacial Surgery
Faculty of Dentistry, Ain shams university*

For their support and help

List of contents

| | |
|---------------------------------------|------------|
| List of tables..... | i |
| List of figures..... | iii |
| List of abbreviations..... | ix |
| Introduction..... | 1 |
| Review of literature..... | 3 |
| Aim of the study..... | 26 |
| Methodology..... | 27 |
| Results..... | 67 |
| Discussion..... | 89 |
| Summary & conclusions..... | 100 |
| Recommendations..... | 104 |
| References..... | 105 |
| Arabic summary | |

List of tables

Table (1) Distribution of cases according to gender, age, site of lesion and volume of residual surgical defect.....**68**

Table (2) graft volume reduction among study group throughout follow up period.....**71**

Table (3) Graft volume reduction among control group throughout follow up period.....**71**

Table (4) Comparison between control and study groups regarding percentage of graft volume reduction throughout follow up period.....**73**

Table (5) Residual surgical defect volume reduction among study group throughout follow up period.....**74**

Table (6) Residual surgical defect volume reduction among control group throughout follow up period.....**75**

Table (7) Comparison between control and study groups regarding percentage of residual surgical defect volume reduction throughout follow up period.....**77**

Table (8) Change in residual surgical defect radio-density among study group throughout follow up period.....**78**

Table (9) Change in residual surgical defect radio-density among control group throughout follow up period.....79

Table (10) Comparison between control and study groups regarding percentage of change in residual surgical defect radio-density throughout follow up period.....81

Table (11) Comparison between group A and group B regarding mean area fraction.....85

List of figures

| | |
|---|----|
| Figure (1) Muco-periosteal flap elevation and exposure of underlying lesion in case number A1 (study group)..... | 41 |
| Figure (2) Residual surgical defect following enucleation of the lesion..... | 41 |
| Figure (3) Nano-hydroxy apatite granules 1 mm particle size..... | 42 |
| Figure (4) Complete filing of residual surgical defect using Nano-hydroxy apatite granules..... | 42 |
| Figure (5) Muco-periosteal flap closure | 43 |
| Figure (6) Bone marrow aspiration trocar needle | 43 |
| Figure (7) Bone marrow aspiration procedure | 44 |
| Figure (8) Centrifugation of bone marrow aspirate..... | 44 |
| Figure (9) Buffy coat layer rich in mono-nuclear mesenchymal stem cells..... | 45 |
| Figure (10) Mesenchymal stem cells rich pellet in the bottom of the tube after third centrifuge..... | 45 |

| | |
|--|-----------|
| Figure (11) Injection of bone marrow aspirate concentrate into the grafted site..... | 46 |
| Figure (12) Residual surgical defect after cyst enucleation in case number B2 (control group) | 46 |
| Figure (13) Skin incision 1 cm posterior to anterior superior iliac spine..... | 47 |
| Figure (14) Periosteal incision and reflection exposing medial cortex of the ilium..... | 47 |
| Figure (15) Trap door approach for harvesting cancellous bone..... | 48 |
| Figure (16) Suturing of muscular and sub-cutaneous layers..... | 48 |
| Figure (17) Sub-cuticular suturing of skin layer..... | 49 |
| Figure (18) Collection of harvested cancellous bone in a plastic syringe to measure its volume..... | 49 |
| Figure (19) Packing of harvested cancellous bone into residual surgical defects..... | 50 |
| Figure (20) iCAT machine..... | 50 |
| Figure (21) Free hand tracing of the graft material in Mimex software. A. adjustment of window level and window width to clearly extract the border | |

between the graft and normal bone, B. Free hand tracing on sagittal cut, C. Free hand tracing on axial cut.....51

Figure (22) 3D reconstructed image showing segmentation of the grafted area to measure its volume separately using Mimex software.....52

Figure (23) Harvesting bone marrow tissue from tibia and femur bones of the rabbits.....61

Figure (24) Bone marrow tissues diluted by DMEM.....61

Figure (25) Filtration of bone marrow tissues treated with collagenase prior to centrifugation.....62

Figure (26) Cannulation of auricular vein for induction of general anaesthesia.....62

Figure (27) Mid-line sagittal incision exposing parietal bones.....63

Figure (28) Bilateral surgically created 10 mm defects in the parietal bones using 10 mm trephine drill.....63

Figure (29) Grafting of surgically created defects with Nano-hydroxy apatite granules and autogenous bone in the right and left sides respectively.....64

Figure (30) Adding bone marrow concentrate to the surgically created defect grafted with Nano-hydroxy apatite granules.....64

| | |
|---|----|
| Figure (31) Incision closure using polyglycolic acid resorbable suture..... | 65 |
| Figure (32) Dissected rabbit's skull prior histological assessment..... | 65 |
| Figure (33) Plate showing steps for the histomorphometric analysis of goldner's trichrome stained sections..... | 66 |
| Figure (34) Scatter diagram showing the degree of agreements for the intra-observer reliability..... | 70 |
| Figure (35) Change in graft volume among control and study groups throughout follow up period..... | 72 |
| Figure (36) Comparison between control and study groups regarding percentage of graft volume reduction throughout follow up period..... | 73 |
| Figure (37) Change in residual surgical defect volume among control and study groups throughout follow up period..... | 75 |
| Figure (38) Comparison between control and study groups regarding percentage of residual surgical defect volume reduction throughout follow up period..... | 77 |
| Figure (39) Change in residual surgical defect radio-density among control and study groups throughout follow up period..... | 79 |

Figure (40) Comparison between control and study groups regarding percentage of change in residual surgical defect radio-density throughout follow up period.....81

Figure (41) Postoperative CBCT scan (axial and sagittal cuts) for residual surgical defect reconstructed BMC + Nano-hydroxyapatite granules. A. immediate postoperative, B. six months postoperative, C one year postoperative.....82

Figure (42) Postoperative CBCT scan (axial and sagittal cuts) for residual surgical defect reconstructed by autogenous cancellous bone graft (iliac crest). A. immediate postoperative, B. six months postoperative, C one year postoperative.....83

Figure (43) Comparison between group A and group B regarding mean area fraction.....85

Figure (44) A photomicrograph of a surgical defect reconstructed by BMC and alloplast, stained with (H&E).....86

Figure (45) A photomicrograph of a surgical defect reconstructed by autogenous bone stained with (H&E).....86

Figure (46) A photomicrograph of a surgical defect reconstructed by BMC and alloplast bone stained with (GT) (Original magnification X4).....87

Figure (47) A photomicrograph of a surgical defect reconstructed by BMC and alloplast, stained with (GT) (Original magnification X20).....87