
# The Effect of Undifferentiated Mesenchymal Bone Marrow Stem Cells on The Healing of Fresh Extraction Bony Sockets

***Thesis***

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***Oral Medicine, Oral Diagnosis and Periodontology***

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# تأثير خلايا نخاع العظام الجذعية على التئام الحويصلات العظمية للاسنان حديثة الخلع

رسالة
مقدمة إلى قسم طب الفم وعلاج اللثة والتشخيص والأشعة
كجزء من مقومات الحصول على درجة الماجستير
فى طب الفم وعلاج اللثة والتشخيص

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# SUMMARY

Tissue engineering approaches have recently proven to be very effective in bone regeneration ***(Zhu et al., 2006).***

An ideal tissue-engineered bone substitute for autologous bone transplantation should possess 3 elements: Osteoprogenitor cells, osteoinductive factors, and an osteoconductive scaffold ***(Joseph et al., 1999)***

The present study is a split mouth experimental study performed on ten 9-months old Male mongrel dogs , Weighing 7–9 kg and in an orally and systemically healthy condition.

The dogs were divided according to the follow up period into two groups: A and B with five dogs in each group.

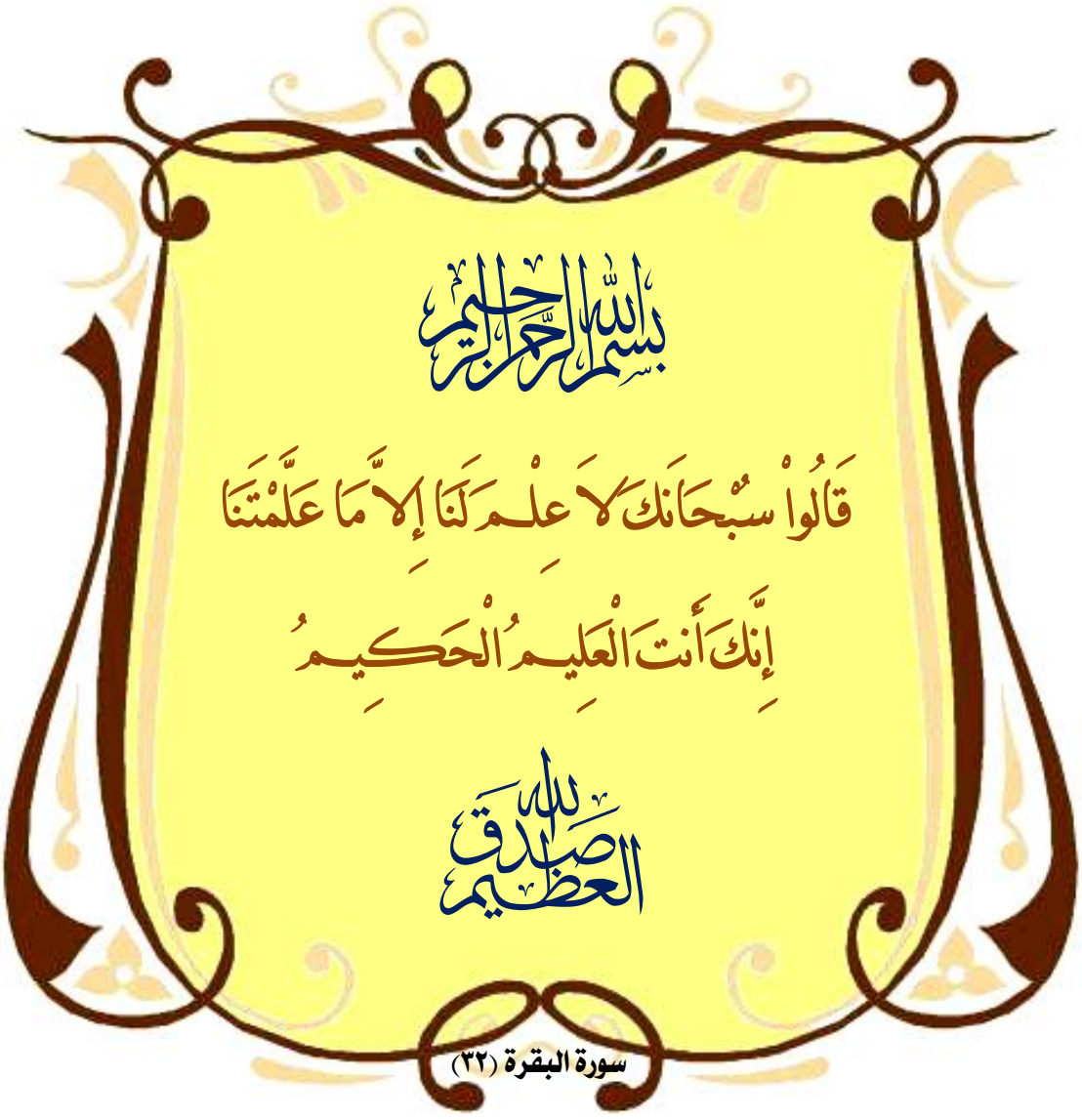
**Group (A):** five dogs were followed up for 1.5 month.

**Group (B):** five dogs were followed up for 3 months.

In each group, the upper lateral second incisor's sites were selected, where the left side was chosen to be the experimental site and the right site, the positive control site.

**At the experimental site:** polymer scaffold seeded with bone marrow derived mesenchymal stem cells (BM-MSCs) will be inserted after dental extraction.

**At the positive control site**: unseeded polymer scaffold will be inserted after dental extraction.




سورة البقرة (٣٢)

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***Mahmoud Khaled El Ashiry***

# DEDICATION

*I would like to dedicate this thesis to my Grandfather, may his soul rest in peace, who has always been my mentor in life and throughout my scientific endeavors. His constant support and encouragement helped me become the person I am today and his guidance will remain with me forever.*

*I would also like to dedicate this thesis to my beloved parents, Prof. Dr. Khaled EL-Ashiry and Ass. Prof. Dr. Eman Anwar El Ashiry, to whom I am greatly indebted, I owe them my deepest gratitude , for giving me the opportunity of an education from the best institutions and support throughout my life.*

*I can't find words to express my gratitude to my wife, I would like to thank her for her support and encouragement. I couldn't have completed this effort without her assistance, tolerance and enthusiasm, and of course my daughter ,my little angel, she's always been my inspiration, may God bless her.*

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# LIST OF CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

# INTRODUCTION

Bone regeneration in the cranio-maxillofacial skeleton has undergone many advances over a short period of time. There is much activity in this area, where autogenous bone grafting still plays a significant role in clinical practice. Cranio-maxillofacial osseous reconstruction represents a very large potential market affecting many surgical specialties including oral maxillofacial surgery, plastic surgery, otolaryngology, neurosurgery, general surgery and head and neck oncology. The area is also of vital interest to most specialties of dentistry including periodontics, orthodontics, endodontics, and even general dental practice. Indeed these combined specialties form the market basis for the development of any commercial products. Some have proven to be useful, others have been most disappointing. The future of tissue engineering in this particular anatomic area is not only bright, it is necessary. Dento-alveolar bony defects are very common and pose a significant problem in dental treatment and rehabilitation. There are many patients who are just now discovering the fact that their jaws can be reconstructed with dental implants. Most of these patients require osseous reconstruction as well. This is the basis for the demand and market for dentoalveolar reconstruction. The ultimate goal is to help increase patient acceptance and utilization of such

techniques. The reduction in morbidity could come from two approaches, either by the development of less invasive bone graft harvesting techniques or by the elimination of the bone graft donor sites by using a bone graft substitute or tissue engineering techniques. This means that tissue engineering principles and techniques can now take their rightful place in the armamentarium of the oral and maxillofacial surgeon who seeks to reconstruct the tooth bearing parts of the jaws using these novel techniques. ***(Sàndor et al., 2003)***

# REVIEW OF LITERATURE

Bone is a specialized connective tissue with a mineralized extra-cellular matrix that provide support, form and rigidity for the human skeleton and supplies a vast store of calcium necessary for calcium related homeostasis ***(Whybro et al., 1998)***. Embryologically, bone is formed by two separate developmental processes described as intramembranous and endochondral ossification ***(Bortell et al., 1990)***. Bone is composed of four cell types; osteoblasts, osteocytes, osteoclasts and bone lining cells.

Osteoblasts are cuboidal cells having a prominent golgi apparatus and well-developed rough endoplasmic reticulum, a histological sign of protein production. These fully differentiated cells secrete both the type I collagen and the non-collagenous proteins of bone's organic matrix. They also regulate the mineralization of this matrix. The osteocyte is thought to be a mature osteoblast that becomes trapped within the bone matrix. While their primary function is maintenance, they have demonstrated abilities to both synthesize and resorb bone ***(Martin and Ng, 1994)***. Bone lining cells are flat, fusiform cells that are found covering inactive bone surfaces. Little is known about the function of these cells; however they may be the precursors of osteoblasts. It is understood that certain cells (osteoprogenitor cells) are programmed to become bone cells and their origin is believed to lie within the primitive mesenchymal stem cells (***Drivdahl et al., 1981)***. Osteoclasts, unlike the other bone cells, which have local origins, arise from the fusion of mononuclear