

**The Role of VEGF and BMP7 in Bone Healing After
Topical or Systemic Fluoride Application
(Experimental Study in Rats)**

**THESIS SUBMITTED TO THE COUNCIL OF COLLEGE OF
DENTISTRY, BAGHDAD UNIVERSITY, IN PARTIAL
FULFILLMENT OF REQUIREMENTS FOR THE DEGREE
OF MASTER IN ORAL HISTOLOGY AND BIOLOGY**

Submitted by

Ahmed Dheyaa Neamah

B.D.S.

Supervised by

Prof. Dr. Athraa Y. Al-Hijazi

B.D.S., MSc., Ph.D.

1434 A.H.

2013 A.D

Abstract

Background: Bone is a specialized connective tissue, has two principle functions. Offering the primary support and protection needed by the body's soft tissues, and it serves as an important dynamic calcium reservoir that participates in the regulation of blood calcium concentration. Bone mineral is primarily calcium and phosphate, deposited in the form of hydroxyapatite crystals on the collagen fibers.

Fluoride is the ionic form of the element fluorine, the thirteenth most abundant element in the crust of the Earth. Because of its high affinity for calcium, fluoride is mainly associated with calcified tissues (i.e., bones and teeth). The ability of fluoride to inhibit, and even reverse, the initiation and progression of dental caries is well known, inhibition of demineralization, enhancement of remineralization, and inhibition of bacterial activity in dental plaque. This database oriented the present project to use fluoride in bone defect.

Aim of the study: To illustrates the effect of topical or systemic application of different type fluoride on bone healing by studying bone repair, histological and immunohistochemical evaluation for expression of VEGF and BMP7.

Materials and Methods: One hundred twenty Swiss rats were used in the present study. Bone defect was created in rat femur with topical application of different types of fluoride include: paste, gel, crushed tablet and systemic fluoride through water supplement, while

control group left without any application. The animals were sacrificed at periods 3, 7, 14, and 28 days. Six rats for each group and for each period.

Histological and immunohistochemical evaluation for VEGF and BMP7 were carried out for all animals.

Results:

A. For H&E findings

1. All study groups showed deposition of osteoid tissue in the period of 7 days except for crushed tablets group which illustrated deposition of only collagen matrix.
2. Mature bone illustrated only in paste group while other groups showed immature bone at 28 days.

B. For Immunohistochemical findings of Vascular endothelial growth factor

1. Positive expression for VEGF by bone marrow stromal cells, adipocytes, and mesenchymal stem cells in different periods is reported in all groups. Statistical analysis for the positivity revealed that according to groups, paste group recorded the highest value in the mean of positive VEGF, and according to periods, the 14 days period recorded the highest value.
2. Positive expression for VEGF by bone cells (osteoblast, osteocyte, osteoclast), in different periods are reported in all groups. Statistical analysis for the positivity revealed that according to groups, paste group recorded the highest value in the mean of positive VEGF, and according to types of bone cell, osteocyte

recorded the highest value and according to periods, the 14 days period recorded the highest value.

C. For Immunohistochemical findings of Bone morphogenic protein -7

1. Expression of BMP7 by bone marrow stromal cells in all groups, in different periods illustrated positivity in different percentage, in control, paste, gel, and crushed, except systemic group showed a negative result at 28 days. Statistical analysis for the positivity revealed that according to groups, paste group recorded the highest value in the mean of positive BMP7, and according to periods, the 3 days period recorded the highest value.
2. Positive expressions for BMP7 by bone cells (osteoblast, osteocyte) in different periods are reported in all groups, except systemic group illustrated positivity by few cells of osteocytes. Statistical analysis for the positivity revealed that according to groups, gel group recorded the highest value in the mean of positive BMP7, and according to types of bone cells, osteoblast and osteocyte recorded the same value and according to periods, the 28 days period recorded the highest value.

Conclusion: The study concluded that fluoride from fluoridated tooth paste enhance bone maturation more than other types, and has effect on VEGF and BMP7 expression.