



OSTEOGENESIS IN THE HEALING OF

THE EXTRACTION WOUND

CHAU Kai-Kin, B.D.S.Hons.

Thesis submitted for the degree of

MASTER OF DENTAL SURGERY

DEPARTMENT OF DENTAL SCIENCE

UNIVERSITY OF ADELAIDE

1968

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PRECIS

In a preliminary study, it was found that certain features in the healing of the extraction wound in experimental animals were inconsistent with conventional descriptions. In addition to the formation of new bone within the alveolar socket, bone was also formed subperiosteally on the buccal surface. The present investigation is an extension of the above study.

A hooded strain of the Norwegian rat in which a maxillary molar was removed has been used, and the healing process that followed was studied with the use of:-

1. Intra-vital staining of new bone with
  - (a) demethyl-chlortetracycline,
  - (b) chlorazol fast pink.
2. Localization of mitotic activities with colchicine.
3. Some histo-chemical observations of extra-cellular components which were also made along with routine histological techniques.

The results indicate that there is a close parallel between healing in fractures, in cortical defects in bone and in the alveolar extraction wound, by the formation of "periosteal", "endosteal" and "uniting" callus.

However, the formation of buccal periosteal bone in the extraction wound was a variable feature and appeared to be related to the presence of inflammation. Inflammation in the periosteum could arise from (a) a direct extension from the oral wound, or (b) indirectly across the alveolar socket wall. The lack of periosteal bone formation in the nasal and palatal surfaces of the maxilla cannot be explained.

Comparison with repair of bone in other situations suggests that under certain circumstances, inflammation will lead to periosteal bone formation.

Food impaction and sequestration of necrotic bone and/or root fragments leads to intensive inflammation in the socket. This intensive inflammation delayed wound healing and bone formation in the socket.

Endosteal bone formation, analogous to the endosteal callus in the healing of a fracture, was also noted in some specimens.



DECLARATION

This thesis is submitted in fulfilment of the requirements for the Degree of Master of Dental Surgery in the University of Adelaide. Candidature for the Degree was satisfied by obtaining the Honours Degree (First Class) of Bachelor of Dental Surgery in 1965.

This thesis contains no material which, except where due mention is made, has been accepted for the award of any other degree or diploma in any University. To the best of my knowledge, this thesis contains no material previously published or written by another person, except where due reference has been made in the text.

The results of the present investigation have been presented in part to the meeting of the International Association for Dental Research (Australian Section) 1967.

CHAU Kai-Kin

ACKNOWLEDGEMENTS

The author wishes to record his sincere gratitude to his supervisor, Dr. J.A. Cran, Reader in Oral Pathology and Oral Surgery, the University of Adelaide, for the opportunities he has made available for this study and for his constant advice, encouragement and patience.

To the staff of the Histo-pathology Laboratory, of the Division of Oral Pathology and Oral Surgery, and in particular to Mr. D.E. Smale, the author is very much indebted for their co-operation and technical assistance. To these persons, and to Miss K. Shertock, who prepared the photographic illustrations, the author also wishes to record his appreciation.

Thanks are also due to Prof. E. Storey, the University of Melbourne, for the opportunity for learning the techniques of intra-vital bone staining and the preparation for sectioning of undecalcified tissues.

Lastly, the author wishes to thank Miss E.B. James and Mrs. R. Scantlebury for their care taken in the typing of this manuscript.



## INTRODUCTION

Although wound healing is the basis of surgical science the intricate mechanisms of this essential process are by no means understood. It is not until recently that attempts have been made to correlate the histological, biochemical and physical aspects of wound healing.

Because of its hard physical nature, bone tissue poses special problems which have, for a long time, defied the application of experimental methods which have yielded results in investigations in healing of soft tissues.

Under normal conditions, wounds of the mouth heal rapidly and without measurable systemic effects. Relatively few detailed investigations, either clinical or experimental, have been concerned with this subject.

Discrepancies in the literature regarding the histogenesis of various tissues associated with alveolar socket wound healing prompted a preliminary investigation by the author. As an outcome of this, certain features in the healing of the extraction wound were noted which called for further investigation.

The present investigation is an attempt at applying some techniques of studying calcified tissues to the healing of

extraction wounds. At the same time, the wound has also been studied from the histological and histochemical angle. An attempt was made to compare and correlate the healing of this intra-oral wound with the healing of a fracture in long bones and healing of cortical defects in bone.

The effect of feeding madder root on the bones of pigs, first observed during the middle of the eighteenth century, gave anatomists of that period a tool for following the development of and repair processes in bone. The basic observations of early workers are still valid, and constitute the foundation of cellular bone physiology as it exists today. The techniques of intra-vital staining of bone using various markers are refinements of the same principle and these form the first part of the present investigation.

In recent years many methods of tagging and labelling cells have become available with the use of radio-active isotopes and have afforded a means of studying the origin and fate of cellular components in tissues. Less accurate and sophisticated methods have also been available which enable a limited insight into cellular activities. One of these latter methods, the use of colchicine, has been applied in the present investigation to observe the mitotic activities of various cellular components in bone repair.

The role of the ground substances and the extra-cellular components have been emphasised in recent studies on wound healing. Histochemical methods afford a means of identifying various biochemical components present in the healing wound and form a subsidiary approach to the present study of osseous repair.

In the first section of this thesis, the relevant literature on various aspects of bone repair and osteogenesis are reviewed. The theoretical basis of methods used in the present investigation is discussed. The second section reports the methods and findings.