

# **Pathological Basis of Root Canal Restoration**

**Using Calcium Hydroxide Paste**

Toshiyuki Kawakami

Editor

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# Pathological Basis of Root Canal Restoration

## Using Calcium Hydroxide Paste

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## Preface

For root canal restoration performed after endodontic treatment, calcium hydroxide has been used for many years, and many related products are commercially available. Numerous research studies of root canal restoration based on animal experiments have been published in scientific journals, and the results indicate that there is a pathological background to root canal restoration. However, despite a careful search of the literature, I have been unable to locate detailed descriptions of animal experiments regarding tissue reactions and the fate of the root canal filling materials. Furthermore, there seem to be no detailed textbook descriptions of the histopathological results of animal experiments.

My goal in publishing this collection of articles on the pathological basis of root canal restoration using calcium hydroxide paste is to help clinical dentists understand that reactions can be induced in the periodontal tissue around the root apex by root canal filling materials. I have carried out work on this particular theme throughout my 35-year research career, first in the Department of Oral Pathology at Matsumoto Dental University under Shigeo Eda (now Professor Emeritus), and presently in the Hard Tissue Pathology Unit of the Matsumoto Dental University Institute for Oral Science. I believe that the study of the pathological background of root canal filling following endodontic treatment is an important topic for dental students to consider, and the contents of this book offer useful findings based on studies of the histopathological background of root canal restoration.

The article in Chapter 1 serves as an introduction to the topic, and it provides an outline of endodontic treatment and root canal filling, and includes comments on the use of materials. Chapters 2 to 5 are based on comparative examination results. Chapter 2 describes the subcutaneous tissue reactions elicited by embedded root canal filling paste, using experimental rats and mice. Topics covered include resorption of, phagocytosis of, and calcification due to the materials in the embedding site. Chapter 3 provides research results on the fate of embedded calcium hydroxide paste components in the animal (rat) body. Chapter 4 describes injury and recovery reactions due to the penetration of root canal material into the mandibular canals of dogs. Chapter 5 describes the tissue reactions of the periapical tissues after root canal filling of deciduous teeth of dogs using calcium hydroxide paste. This includes histopathological and electron-microscopic examination results. Furthermore, the cytological nature of the foreign body giant cells for phagocytosis of hydroxyapatite is described.

Chapters 6 to 13 are more clinically oriented. In Chapter 6, the histopathological results of deciduous teeth of dogs are described. Chapter 7 presents the research results of a clinical and x-ray examination study of human deciduous teeth. Chapter 8 concerns animal experiments on root canal therapy for infected non-vital permanent teeth having incompletely formed roots, while Chapter 9 concerns clinical and x-ray observations of root canal therapy in permanent teeth with incompletely formed roots. Chapter 10 describes the histopathological evaluation of root canal filling material using dogs, and Chapter 11 presents the histopathological evaluation of combined root canal filling in dogs. Chapter 12 is the histopathological examination of a 'simultaneously folded' method with paste combined root canal filling methods in dog's teeth. The final section, Chapter 13, offers a case presentation of aged patients treated using calcium hydroxide paste.

I hope that this work provides dental students with an understanding of the biological basis of root canal filling. Moreover, I also hope that this book may be of use to clinicians engaged in

daily dental examination.

On the First Day of Spring, 2012

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In compiling this work, my task was comparatively easy since our research has all been previously published, and since this was the effort of many, including the present staff of the Hard Tissue Pathology Unit, Matsumoto Dental University Institute for Oral Science; and the staff of the Department of Oral Pathology, Matsumoto Dental University School of Dentistry. Members of the latter department include Dr Hiromasa Hasegawa, Professor; Dr Keisuke Nakano, Associate Professor; Dr Chihito Nakamura, Assistant Professor; Dr Motoyoshi Antoh, Assistant Professor; Dr Noriyuki Takei, Assistant Professor; and Dr Takanaga Ochiai, Assistant Professor. In addition, the research contributions includes that of many other staff members, too numerous to mention, from the Department of Oral Pathology and the Hard Tissue Pathology Unit of the Institute for Oral Science.

Moreover, additional collaborators were invited to contribute to this work, including Dr Mihoko Tomida, Associate Professor in the Department of Oral Physiology at Matsumoto Dental University School of Dentistry, and Dr Masahiro Sato, Assistant Professor in the Department of Endodontics and Operative Dentistry at Matsumoto Dental University School of Dentistry. Their work comprises Chapters 1 to 5 and 13, and these investigations were carried out in the Hard Tissue Pathology Unit and in the Department of Oral Pathology, with most of the results dealing with the fundamentals of root canal filling. In using laboratory dogs for conservative dentistry research, I received cooperation from three longtime colleagues—Drs Shinzo Teramoto, Toshiyuki Shibuya and Toshiro Yumii of the Department of Conservative Dentistry, Tokyo Dental College. Their work comprises Chapters 10, 11 and 12.

Moreover, the examination into the clinico-pathological results of root canal filling for deciduous and immature permanent teeth of dogs and humans was led by Dr Yukio Machida, Professor Emeritus at Tokyo Dental College; his work makes up Chapters 6 to 9.

The research data provided by Dr Tomohiro Fuchino, Dr Takaya Mizutani, and Dr Hiromichi Fujii, Assistant Professor in the Department of Pediatric Dentistry at Tokyo Dental College makes up four chapters.

I am deeply thankful to the Language Editor, Mr David M Carlson, Professor of English at Matsumoto Dental University School of Dentistry.

The publication of this book, by IDP Publishing, Inc., came about thanks to the kind introduction of Mr Hiroshi Ozawa of MDU Press, who was involved in the production of this book from the planning stage. I would especially like to express my gratitude to Mr Isao Izumi, President of IDP Publishing, Inc., for kindly agreeing to publish this work. Fujiwara Printing Co., Inc, located here in Matsumoto, took charge of the actual printing; I am thankful to Mr Nagaharu Ushikoshi of the Sales Department, and to Mr Takamichi Fujiwara of the Production Control Department. Moreover, Mr Tadao Nishiyama, a classmate of mine from high school, by chance, cooperated on this work, and I wish to express my gratitude to him, as well.

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On the First Day of Spring, 2012

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