

Pediatric Endodontics

Current Concepts in
Pulp Therapy for Primary and
Young Permanent Teeth

Anna B. Fuks
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*This book is dedicated to
Moises Fuks, my beloved husband and
long-term companion and friend
and to
Tamar, Neta and Alona Peretz, my beloved
and precious family*
Anna B. Fuks and Benjamin Peretz

Preface

The initial idea for writing this book came because we felt that there has been an explosion of scientific knowledge on the understanding of the pulp tissue in the last two decades, which, in turn, affect the proper treatment for various pulp pathological conditions. This immense advancement has included the primary pulp also, and pediatric dentistry today, with regard to pulp treatment, can provide a better, more problem-oriented therapy and treatment to the affected primary pulp. Therefore, when we were approached by the Springer representative to write this book, we gladly agreed.

We felt that there was a need for students, undergraduate and postgraduate alike, as well as for the professional community to be familiarized with the current “state of the art” on pediatric endodontics. We made all efforts to cover the various aspects of the dentin-pulp complex in pediatric dentistry: from the understanding of biological concepts of the healthy pulp, through the pulp reactions to the deleterious effects of caries, to the various treatment modalities for each type of pulp injury, to the adverse reactions to various pulp dressing materials, and to the postoperative prognosis.

The better understanding of these topics led us to conclude that a conservative approach in the treatment of reversibly inflamed pulp needs to be emphasized. Thus, considerable attention has been given to the conservative approach to pulp treatment in primary and young permanent teeth. Our message stresses the paradigm shift toward conservative treatment modalities, relying on an accurate diagnosis based on signs and symptoms to assess the appropriateness of the technique for a specific case.

Notwithstanding, the traditional modes of treatment are also covered.

Understanding the new concepts regarding pulp treatment will guide practicing pediatric dentists and general dentists to select the proper mode of treatment.

A special emphasis has also been given to the future of pulp treatment, in light of the innovative knowledge on stem cells. At present, there is a consensus that the future of medicine and dentistry, particularly of pulp treatment, lies in the thorough research on stem cells.

We hope that this text will be useful to all students and dentists who treat children, to provide a better care for their teeth.

Jerusalem, Israel
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Pediatric Endodontics: Past and Present Perspectives and Future Directions

1

Anna B. Fuks and Benjamin Peretz

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Dentistry for children is one of the most needed of all specialties in dentistry. Yet, unawareness of newer concepts of present-day pediatric dentistry practice and the ultimate goals to be achieved still exist. The value of teaching pediatric dentistry cannot be overestimated as inadequate or unsatisfactory dental treatment during childhood may damage permanently the entire masticatory apparatus, leaving the individual with many of the dental problems so common in today's adult population [1].

The utmost goals of modern pediatric dentistry are to bring children into the permanent dentition after natural exfoliation of their healthy and/or properly treated primary teeth and instill a positive attitude toward keeping habits of optimal dental and oral health.

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1.1 Pediatric Endodontics

Pediatric dentistry is a unique specialty that deals with the total and comprehensive oral health care of children. As such, it involves all aspects of oral care ranging from prevention to restorative treatments. Historically, pediatric dentistry has evolved from an extraction-oriented practice at the beginning, where primary teeth with inflamed pulps were mostly extracted, and no focus has been put on preserving the pulp, to a specialty based on emphasizing prevention of oral and dental diseases.

A more conservative approach has been developed during the last decades regarding dental caries and specific modes of treatment such as minimal invasive dentistry and an increase use of prevention materials (mainly containing fluoride). This approach has been attributed to both developed diagnostic criteria and tools and to the new dental products and materials in the market. This approach goes further with regard to pulp therapy. It has long been established that the human dental pulp has a remarkable potential for self-healing when encountering a severe insult, especially in young patients, mainly due to the high degree of cellularity and vascularity. Incomplete caries removal, stepwise excavation, and indirect pulp treatment have been proposed to treat reversibly inflamed pulps. In addition, several techniques for managing irreversibly inflamed or necrotic pulps have been introduced in pediatric dentistry practice. Exposure of the pulp may occasionally be due to caries but may also occur by accident during cavity preparation or by fracture of the crown of the permanent maxillary incisors in particular.

Despite the extensive progress that has been achieved in prevention of dental caries worldwide, and the variety of treatment modalities to treat inflamed and/or infected pulp, a remarkable number of complications of untreated or poorly treated primary teeth and/or young immature permanent teeth are still encountered. This demands exact diagnosis, thorough knowledge of pulpal conditions and therapies, and also the value of the individual tooth for the occlusal development. Hence, pediatric endodontics has its own characteristics and includes the pulpal treatment of primary and young immature permanent teeth. It must always be seen in the total context of the dentition and the patient.

A review of the anatomy of primary teeth readily explains the frequent need for pulp therapy in these teeth. Specifically, Finn [1] and Ash [2] described twelve basic differences between primary and permanent teeth that can be summarized as follows: the enamel is thinner on primary teeth than on permanent teeth, and the thickness of the dentin between the pulp chambers and the enamel in primary teeth is less than in permanent teeth. The pulp, therefore, is correspondingly closer to the outer surface, and dental caries can progress and penetrate into the dentin more rapidly, leaving the tooth more susceptible to infection. Thus, pulp exposures caused by caries occur more frequently in primary teeth. If infection spreads to the alveolar bone, the developing permanent tooth may also be affected.

Pulp treatment of young permanent teeth must take into consideration the life expectancy of the young patient and provide the best conditions for the roots to develop and mature.

The practitioner should be familiar with the different treatment approaches to be able to select the most appropriate modality for each specific clinical situation.

1.2 Historical Perspective

The first method of capping exposed pulps was described by Phillip Pfaff, a dentist at the court of the Prussian King Friedrich II in Berlin in 1756 who used gold foils [3]. Several agents for direct pulp capping have been recommended ever since. The assumption that the pulp tissue must be irritated by cauterization in order to heal prevailed until the end of the nineteenth century, and most materials were used empirically. At the beginning of the twentieth century, it became obvious that microorganisms were the reason for pulp inflammation, and more attention was drawn to disinfecting agents that, although effective, were very cytotoxic. The lack of proper tools for achieving accurate diagnoses led to insufficient assessment of the pulp status leading to incorrect treatment selection. Thus, due to this fact, necrotic pulps were sometimes capped [3].

The first scientific clinical study to compare different capping materials was made by Dätwyler in 1921, whereupon zinc oxide-eugenol showed the best results. One year later, Rebel performed the first animal experiments with disastrous results, so he regarded the exposed pulp as a doomed organ. In 1920, Hermann introduced calcium hydroxide for root canal fillings. Between 1928 and 1930 he studied the reaction of vital pulp tissue to calcium hydroxide to prove that it was a biocompatible material. Since then, calcium hydroxide has been recommended by several authors for direct pulp capping, but it was only in the middle of the twentieth century was it regarded as the standard of care [3].

A Shift in the Paradigm of Treating Pulpally Involved Teeth

A change in clinical approach to pulpally involved teeth in pediatric patients will be proposed in this book and will be described in the different chapters. The change in approach involves a shift in the traditional paradigm regarding reversibly inflamed pulp from an “aggressive” approach involving total excavation of the carious dentin and the danger of exposing the pulp, towards a more “conservative” approach in which caries may be left in the pulpal wall to prevent pulp exposure. This approach is being slowly spread in the dental profession, and may become the treatment of choice for deep caries in modern pediatric dentistry practice.

As long as minimal invasive dentistry is still reluctantly accepted by the professional community many teeth with reversible pulp inflammation, that could otherwise be conservatively treated, will become pulpally involved. These teeth will be treated by the different pulp treatment modalities that will be described in this book.

1.3 The Scope of the Book

The nine chapters of this book will describe in detail the developmental and biomedical aspects of the primary pulp and comprehensive clinical diagnosis of the pulp leading to conservative approaches of pulp therapy, including stepwise excavation, indirect pulp treatment (IPT), and direct pulp capping. In the chapter on stepwise excavation and IPT, the Hall technique is mentioned. This technique, which

includes cementation of a stainless steel crown on primary teeth without any caries removal or tooth preparation, has been shown to be successful in several clinical studies [4]. As this technique contradicts all established accepted principles of good clinical practice and it is still unknown what is the long-term effect on the development of the occlusion, the Hall technique is definitely a proof that after an accurate diagnosis, caries can be left on a tooth if properly sealed.

Furthermore, even though our message emphasizes the shift toward conservative approaches, these rely on an accurate diagnosis based on signs and symptoms to check the appropriateness of the technique for a specific case. Evidently, a thorough radiographic evaluation is essential for proper diagnosis. Thus, when a conservative approach is not indicated, the pulpotomy technique, as old as it is (over 40 years), will be presented, and the various dressing materials will be critically discussed. In addition, the nature of successful treatment and, more importantly, failures will be described.

Following the chapter on pulpotomy, an extensive and detailed chapter on pulpectomy and root canal filling (RCT) will be presented, describing in detail the rationale behind RCT, the techniques to perform RCT, the instruments, and the associated materials. Again, the success and failure rates of RCT will be described.

A special chapter will be dedicated to the importance of appropriate restorations of pulpally treated teeth, emphasizing the need of leakage prevention to improve the final prognosis.

Although this book is mainly dedicated to primary teeth, as previously mentioned, children often present pulp pathology in their immature permanent teeth. These teeth deserve a different treatment approach than the permanent teeth in adults, and for this reason, a special chapter dealing with this subject is included.

Finally, innovative experimental biological treatment modalities such as using stem cells, a new and developing area in medicine and in dentistry, will be presented. This approach will no doubt be one of the most prevailing treatment modalities in the future. It will expand the scope of conservative treatments, giving the clinician a more versatile arsenal of tools to deal with the damaged pulp.

1.4 The Aim of the Book

This book is aimed to familiarize dental students as well as general practitioners and pediatric dentists with the different treatment modalities and complications of uncontrolled caries, offering them the tools to diagnose the degree of pulp inflammation and thus select the most appropriate treatment.

This book is meant to be a tribute to Dr. Sidney B. Finn, one of the pioneers in pediatric dentistry and mentor of one of the editors (ABF). Dr. Finn's nice and warm personality, showing always a humane and empathic attitude toward the patients and parents, had a tremendous influence on Dr. Fuks's education and professional formation.

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