The Periodontic-Endodontic Interface

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I dedicate this book to my Mother, Fawziya, and Stepfather, Suhail, who helped me to learn to read and write in English when I first arrived in England. They spent endless hours giving my siblings and I extra homework, spelling tests and marking our various attempts at re-writing the chapters of our favourite books.

Preface

The periodontium consists of the external supporting soft and hard tissues of the tooth. The root canal system houses the internal blood supply to the vital pulp-dentine complex of the tooth (the endodontium) that makes the tooth a living structure. Both the periodontium and the endodontium are at risk of developing disease separately and can be treated separately to varying degrees of success; however, when they present together, combined periodontal and endodontic lesions (perio-endo lesions) are a quandary in treatment. Perio-endo lesions are considered a prognostic indicator for poor outcomes of treatment, usually determined by the outcome of the periodontal treatment. The diagnosis is of importance because those lesions that appear to be perio-endo lesions but are solely of endodontic origin will heal with endodontic intervention, whereas periodontal disease with irreversible endodontic manifestations and true perio-endo lesions will require both periodontal and endodontic treatment, and be reliant on the patient's compliance of good oral hygiene with modification of aetiological factors to achieve success. The aim of this book is to lead the reader to a better understanding of the periodontic-endodontic interface, the aetiology and diagnosis of perio-endo lesions, and therefore, management of such lesions.

London, UK — Dr. Shiyana Eliyas

Eliyas, Periodontic-Endodontic Interface

Text

This book equips dental care providers with a thorough understanding of the Periodontic-Endodontic Interface. It discusses embryonic development of the tooth, oral health and pathology, as well as the diagnosis and management of periodontal disease and endodontic disease, occurring both separately and together. Evidence-based information is given on periodontic and endodontic pathogens, lesions and infections with various forms of their manifestations. The clear and easy-to-read text is complemented by numerous high-quality photographs and tables that assist understanding and help with the identification of management solutions. The book is a valuable resource for all dental practitioners with an interest in endodontics, periodontics, restorative dentistry, and for higher-level students.

USPs

Discusses periodontal and endodontic disease, occurring both separately and together
Includes clinical cases to illustrate practical tips
Gives evidence-based information on lesions, infections and oral health

SEO MetaData

This book equips dental care providers with a thorough understanding of the Periodontic-Endodontic Interface.

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Competing Interests

There are no competing interests in relation to the context of this book.

Contents

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Dr. Eliyas is a Consultant in Restorative Dentistry at St George's University Hospital Foundation Trust. Following graduation from King's College London in 2002, she gained experience in a variety of environments including teaching hospitals, district general hospitals, as well as National Health and Private practice. Dr. Eliyas has undertaken Specialty Training in Restorative Dentistry at Sheffield Teaching Hospitals NHS Foundation Trust and completed a Head and Neck Oral Rehabilitation Fellowship in Manchester and Liverpool Dental Hospitals. She achieved a Doctorate on the feasibility of measuring the quality of post-graduate education in endodontics in primary care using outcomes of endodontic treatment. She has published widely and enjoys teaching and research.

Dr. Eliyas clinical interests lies in the management of complex restorative dental problems including endodontic, periodontal and prosthetic issues as well as the management of peri-implant disease. Her current position includes managing complex restorative problems in high priority patients (head and neck cancer, those with dento-alveolar trauma and those with dental developmental disorders). She is currently the President of the British Society of Prosthodontics.

Introduction

1

Abstract

This chapter gives an introduction to the periodontic-endodontic (perio-endo) interface. It describes the importance of saving teeth and compares the alternative replacement options. The learning objectives of this book are set out at the end of this first chapter.

Introduction

The tissues of the periodontium and endodontium communicate with each other embryologically for their development, anatomically once the tooth has erupted into the oral cavity as part of their normal function during health, as well as pathologically when disease develops. It has been said that 50% of tooth mortality might show periodontal and pulpal pathology (Chen et al. 1997). That coupled with patients living for longer, as well as the recent increasing awareness and motivation of patients to keep their teeth for longer, is likely to mean that the number of teeth needing periodontal and endodontic treatment in the population is vast. Both periodontal and endodontic structures of a tooth are closely linked and the handling of one structure may affect the other.

Generally the periodontic-restorative interface is in the region of the gingival margin of the tooth. The patients and clinicians influence on this area is related to the development of caries and marginal bone loss. The placement of the restoration itself may harm the gingival tissues (trauma from the removal of caries, the placement of rubber dam, matrix bands and wooden wedges, for example) and the material placed may continue to irritate the periodontal tissues long after completion of the procedure. Occasionally there is development of cervical or invasive external resorption, which may also instigate the placement of restorations in this region;

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again the method of restoration (surgical or non-surgical) and material used will impact the reaction of the periodontal tissues, with or without a pathological response.

A 26-year longitudinal study compared periodontal outcomes of teeth with and without restorations impinging on the gingival margin. Those with subgingival margins were prone to more clinical attachment loss and this occurred in the first few years of restoration placement (Schätzle et al. 2001). Where overhangs of restorations were present, inflammation and bleeding on probing has been found (Lang et al. 1983), with more gingival inflammation and bone loss found near restorations (Albandar et al. 1995). Some studies have shown the presence of higher bacterial counts near composite restorations (Paolantonio et al. 2004), whilst others found non-precious metals and acrylic restorations associated with periodontal breakdown (Ababnaeh et al. 2011). Crowns with subgingival margins have been associated with an increase in periodontal pocket depth and attachment loss when compared to supragingival crown margins (Valderhaug and Birkeland 1976; Müller 1986; Reitemeier et al. 2002). Interproximal attachment loss has been found to be associated with caries and restorations; however, flossing showed a protective influence (Broadbent et al. 2006). Following the management of endodontic disease will be restoration of the tooth, and therefore, its impact on the periodontal tissues should not be forgotten.

The perio-endo interface is more complex. Periodontal disease and endodontic disease have been identified, studied and treated for centuries (Carranza et al. 2006; Hargreaves et al. 2011). Both have a variety of non-surgical and surgical care pathways, with the common goal of reducing the microbial load, in order to manage disease, and therefore, prevent eventual loss of the tooth.

The relationship between periodontal and pulpal disease was first described in 1964 (Simring and Goldberg 1964), when the effect of pulpal disease in the causation of, contribution to, and prevention of healing of periodontal disease was first demonstrated using a series of cases. At the time, this was termed ‘retrograde’ periodontitis (disease spreading from the apex of a root to the gingival margin) in order to differentiate it from marginal periodontitis (disease spreading from the gingival margin towards the apex of a root). It was thought that both micro-organisms and their toxins pass from the pulpal tissues to the periodontal tissues, with communications existing via neural pathways, lateral canals, dentinal tubules, the periodontal membrane, alveolar bone, apical foramen, vasculolymphatic drainage and dentinal permeability. It was also noted that both diseases have similar symptoms and signs, making diagnosis difficult. Simring and Goldberg (1964) reported a success rate of 89% for the 109 cases treated over 9 years using a variety of periodontal and endodontic treatment modalities. Although, much of the scientific understanding and rationale have not significantly changed, the methods of treatment and the order of treatment have marginally altered over the years, with emergence of some differing philosophies.

For both periodontal and endodontic disease, many classifications exist (Armitage 1999; Abbott and Yu 2007; European Federation of Periodontology 2019). For the purposes of this book, the discussion will be limited to a broad definition of

periodontal disease and endodontic disease. The basic principles can be extrapolated to other more intricate diagnoses. Periodontal disease or periodontitis, in this book, will be taken to mean the pathological breakdown of the periodontium (inflammation of the gingival tissues, leading to attachment loss and resorption of the alveolar bone as measured from the cemento-enamel junction of a tooth), as a result of infection (plaque and residing bacteria) and inflammation (host response to the presence of plaque and associated bacteria). Endodontic disease, in this book, will be used to describe the loss of vitality of a tooth leading to inflammation and infection within the root canal system, and periradicular tissues as a response to the infection and inflammation within the root canal system of a tooth (requiring non-surgical endodontic treatment), and will include teeth that have already been root canal treated and still continue to house infection either within the canal system or outside the canal system (requiring endodontic re-treatment or surgical endodontics).

The diagnosis and treatment of dental infections that have a combined periodontal and endodontic component is complex, with practitioners having limited confidence to save such teeth, considering them of 'poor' or 'hopeless' prognosis (Simring and Goldberg 1964; Herrera et al. 2018; Khandelwal et al. 2020). Despite this, there are advantages to maintaining natural teeth, even if periodontally and endodontically treated (Eliyas et al. 2018). When a tooth is lost, the alternative to accepting a space is providing one of a variety of prosthetic replacement options (Cohn 2005; Hargreaves et al. 2011; De Backer et al. 2007; Doyle et al. 2007; Torabinejad et al. 2007; John et al. 2007; Zitzmann et al. 2009). Accepting a space may still be a potential option as function has been said to be adequate with a shortened dental arch, as long as there are four opposing posterior units (Kayser 1981). Although a shortened dental arch was not shown to lead dysfunction or discomfort (Witter et al. 1990, 1994; Sarita et al. 2003a), an increased number of chewing strokes are needed for swallowing (Kayser 1981; Sarita et al. 2003b). The movement of adjacent teeth into the space has been shown to be clinically insignificant in periodontally healthy adult patients, with less than 20% of teeth moving more than 2 mm (Love and Adams 1971; Witter et al. 1987, 2001; Kiliaridis et al. 2000; Shugars et al. 2000; Craddock and Youngson 2004; Christou and Kiliaridis 2007). This may be different in periodontally susceptible patients. The options for replacing teeth are removable prostheses (dentures) and fixed prostheses (bridges or implant-retained crowns and bridges).

Removable prostheses are a largely reversible method of restoring spaces, however may not be ideal in patients with periodontal disease or recurrent carious lesions as poor oral hygiene and plaque trapping around the removable prosthesis may lead to the demise of the remaining dentition (Bergman et al. 1995; Do Amaral et al. 2010). There are a number of studies that assessed the association of removable partial dentures with periodontal breakdown, some finding that there was a deleterious effect (Bates and Addy 1978; Seemann 1963; Yusof and Isa 1994) and others finding that good oral hygiene and thoughtful design of connectors can ensure maintenance of healthy periodontal tissues (Bergman et al. 1982; Carlsson et al. 1965; Berg 1985; Petridis and Hempton 2001). There may be the added

difficulty of impression making in the presence of greatly mobile and periodontally involved teeth. Patients may fail to internalise removable appliances and tend not wear these when only posterior teeth are missing (Jepson et al. 1995; Davenport et al. 2000; Knezović Zlatarić et al. 2003; Clark et al. 2004; Allen et al. 2008). No significant differences have been found in patient related outcomes with provision of a removable denture and acceptance of a shortened dental (Wolfart et al. 2005).

Bridges are well tolerated by patients; however, require the presence of suitable bridge abutments (Sonoyama et al. 2002; Szentpetery et al. 2005; Tan et al. 2005; Geiballa et al. 2016). Conventional bridgework will require tooth preparation, with a potential for de-cementation of restorations and need for recycling of restorations (Brägger et al. 2001). Approximately 30% of teeth may lose vitality at 10 years and 35% at 15 years after placement of various fixed-fixed conventional bridge designs (Cheung et al. 2005). Conventional fixed-fixed bridges have a 10-year probability of survival of 89% and 10-year probability of success of 71% (Tan et al. 2004). Cantilevered bridges have a reported survival of 82% and success rate of 63% at 10 years, with the most common cause of complications being loss of pulp vitality of the abutment tooth (Pjetursson et al. 2004). Adhesive bridgework requires little or no preparation, and the failure is simple de-cementation (Djemal et al. 1999; King et al. 2015), especially if cantilever designs are used. If fixed-fixed designs are used there is potential for caries development if one wing de-cements. The median survival for cantilever designs had been reported to be 9.8 years, and that for fixed-fixed designs 7.8 years (Djemal et al. 1999). 65% survival at 10 years had been reported when all designs of resin-retained bridges were pooled in a systematic review of retrospective and prospective cohort studies with a minimum follow-up time of 5 years (Pjetursson et al. 2008). More recently, 80% survival rates for resin-retained bridges at 10 years has been reported (King et al. 2015).

It is often considered ‘ideal’ to offer rehabilitation with implant-retained prostheses. These can work well, but may also be challenging, with difficulty achieving ideal aesthetics and potential risk of damage to other structures (Palmer 1999). The placement of dental implants requires sufficient bone volume and periodontal health. Long-term maintenance is essential (Goodacre et al. 1999, 2003; Brägger et al. 2001; De la Rosa et al. 2013; Atieh et al. 2013; Bidra et al. 2016; Tran et al. 2016). The reported survival rate at 10 years for implant-supported fixed partial dentures is 87%, that for implant-supported single crowns is 98% (Pjetursson et al. 2007). Emerging evidence suggests that 19–65% may develop peri-implant mucositis and 22% of implants may develop peri-implantitis (Derks and Tomasi 2015), the management of which is often difficult, and likely to be even more challenging in an aging population (Roccuzzo et al. 2021). Therefore, it is of advantage to maintain natural teeth, because in an elderly patient, who may develop dementia or Alzheimer’s disease, whose oral health is maintained by carers, it is easier to extract a natural tooth than provide complex dentistry to treat peri-implant disease, when problems arise. Further thought may need to be given to conversion of complex fixed implant-retained prostheses into simpler removable implant-retained prosthesis during the early stages of diagnosis of deteriorating medical health, as the population ages. In patients with treated periodontal disease, the occurrence of

peri-implantitis has been reported to be 16–25.5% (Ong et al. 2008). When endodontic treatment was compared with implant treatment, both showed similar rates of survival, however, with more interventions required for maintaining implant-retained prostheses than endodontically treated teeth (Iqbal and Kim 2007; Doyle et al. 2006; Hannahan and Eleazer 2008). Hence, saving a tooth of strategic importance may well be preferred and should always be considered, even if the alternative appears easier in the short-term (Zitzmann et al. 2010).

Accurate diagnosis facilitates treatment planning and determination of prognosis, which will aid the clinician and patient in making a decision as to whether complex periodontal and endodontic treatment would be of short, medium and long-term benefit. In order to understand perio-endo lesions, it is necessary to understand the development of both structures, their individual disease processes and as well as the available treatment options for the individual diseases. This book aims to describe periodontal and endodontic health and disease, and the potential for communication between the structures at the periodontic-endodontic interface. The various chapters of the book describes examination and special tests useful for diagnosis, and discusses treatment planning, treatment modalities, as well as the prognosis of such treatment for teeth with perio-endo lesions.

Learning Objectives:

1. Develop an understanding of the pulp and periodontal tissues in health.
2. Recognise the close relationship between periodontal and endodontic structures which may lead to perio-endo lesions.
3. Appreciate the limitations of special tests in diagnosis of perio-endo lesions.
4. Comprehend the treatment options for perio-endo lesions and their prognosis.
5. Be able to treatment plan for perio-endo lesions to achieve optimal outcomes.

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