

Clinical Cases in Orthodontics

Martyn T. Cobourne, Padhraig S. Fleming,
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Preface

We think that orthodontics is one of the most interesting and challenging of the dental specialties. Although we might be biased in this assumption, there are some persuasive reasons for believing that it is true. The treatment of malocclusion represents a combination of science and artistic flair, and is often, although not exclusively, carried out on a young and vibrant population. The results of orthodontic treatment and the positive impact that it can have on the patient can also be intensely rewarding for the clinician. Moreover, developments in diagnostic tools, appliance systems and orthodontic materials continue at some considerable pace within the profession, which provides considerable stimulus to the contemporary clinician.

We have written this textbook primarily to be used as a tool for dental professionals who wish to broaden their experience and understanding of clinical orthodontics. The intention has been to show a wide variety of individual cases and clinical scenarios that illustrate many of the problems commonly seen during development of the craniofacial region, with emphasis on the jaws, dentition and occlusion. All of these cases have been treated or directly supervised by the authors, primarily in secondary care, following referral from general practitioners and specialists. We have attempted to illustrate a wide variety of problems that present in the orthodontic clinic, both common and rare, and demonstrate different approaches to their management. Relevant discussion around the etiology, diagnosis and planning of these cases is included in each presentation. We hope that this book will be of particular benefit to postgraduate orthodontic students preparing for

their MSc, MClintDent, DDS and Membership examinations in orthodontics. Indeed, a number of the cases included have been successfully used in recent sittings of these examinations. However, the clinical focus underlying this text should mean that it will also be of benefit to other dental professionals involved in management of the developing occlusion, including therapists and undergraduate dental students – who indeed, represent the orthodontists of the future.

It was not our intention to write a definitive textbook on orthodontics, but rather to illustrate contemporary practice using clinical cases and individual examples. Therefore, the introduction to each chapter gives a general overview of the subject area, which is then followed by a series of cases with appropriate questions and answers. We have included the answers to these questions within the cases to avoid the need for constant reference to other parts of the book. Hopefully, this will make it relatively straightforward for the reader to follow the treatment strategies that have been used. In some of the clinical scenarios, more emphasis has been given to clinical examination and diagnosis; whilst in others, questions focus on the treatment that has been carried out. Indeed, many of these cases have been chosen to illustrate specific aspects of etiology, diagnosis, treatment planning or use of mechanics in the management of malocclusion. This problem-based approach of discussing aspects of malocclusion should allow practising clinicians to develop their skills in the management and care of orthodontic patients, from initial assessment, through to the completion of treatment. However, whilst we strive to achieve clinical excellence for the cases that we treat, we did want to illustrate those that had been treated ‘in the real world’ and therefore have not excluded examples where difficulties have been experienced. In addition, some cases have the cephalometric values provided in the diagnostic

information, whilst some do not. We believe that cephalometrics should be used to supplement the clinical diagnosis and felt that the reader would benefit from having them provided in some, but not all, of the case records included.

In setting out this book, we have attempted to arrange the chapters into a series that progresses logically, although there can be considerable flexibility in the precise order in which they can be read, particularly those chapters dealing with specific malocclusions. Chapter 1 provides an introduction to clinical examination and diagnosis of the orthodontic patient, including the use of radiographic and cephalometric analysis in treatment planning. This chapter also covers aspects of the patient medical history that can be of relevance to orthodontic treatment. Chapter 2 is concerned with postnatal development of the dentition and has been designed to include individual examples of anomalies that can occur during establishment of the dentition (both common and rare), the use of interceptive treatment and major aspects of tooth agenesis. Chapters 3–6 are organized according to the conventional classification of malocclusion and include the management of class I, class II division 1, class II division 2 and class III cases. Chapter 7 covers problems associated with tooth impaction in the permanent dentition and Chapter 8 focuses on fixed orthodontic appliances, using individual examples to demonstrate issues relating to their use and the application of treatment mechanics. Chapter 9 covers the subject of post-treatment stability and the management of retention, whilst Chapter 10 explores diagnosis and treatment of cases requiring a combined orthodontic and surgical approach to correct significant skeletal discrepancies. Finally, Chapter 11 is concerned with the etiology and management of developmental conditions that can affect the craniofacial region.

Inevitably, amongst all of the cases that have been used, there is some repetition of problems that can occur in relation to malocclusion; however, we hope that this adds rather than subtracts from the quality of the text. Indeed, many different philosophies and approaches exist regarding the management of malocclusion and we hope that many of these have been suitably illustrated. This book does not represent a comprehensive text, but hopefully does cover most aspects of contemporary clinical orthodontics through the documentation of treated cases. We hope that the style and content of the book is stimulating and that you as the reader are broadly in agreement with the treatment decisions that have been made and satisfied with the final results that have been achieved.

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Clinical and Cephalometric Analysis

Introduction

Orthodontics is the area of dentistry concerned with the management of deviations from normal occlusion or malocclusion and involves treatment of children, adolescents and, increasingly, adults. Malocclusion is a variation on normal occlusion and is not a disease entity. Consequently, orthodontic planning and management does not involve binary decisions, but rather evaluation of a range of possibilities to decipher the most appropriate option for each individual.

An ideal static occlusion is characterized by class I molar and incisor relationships, with well-aligned teeth. An acceptable occlusion, however, develops naturally in only 30-40% of the population in Western societies. The occurrence of an acceptable occlusion is multi-factorial, although important factors include the size of the jaws; the relationship of the jaws to each other; the size, number and morphology of the teeth; and the morphology and behaviour of the lips, tongue and peri-oral musculature.

Given that malocclusion does not represent a pathological process but rather a variation from an accepted norm, there is little agreement, even among orthodontists, as to when orthodontic treatment becomes necessary (Richmond *et al.*, 1984). As a consequence, a variety of orthodontic indices have been developed to ration treatment where care is

provided as part of a public health service, such as in the UK and Scandinavia (Brook and Shaw, 1989), based primarily on aesthetic and dental health impairment.

The demand for orthodontic treatment has increased universally, particularly over the past two decades. A desire to enhance dental appearance is the underlying motivation for most patients who seek orthodontic treatment (Shaw *et al.*, 1991). Furthermore, the lay public has developed an increasing awareness of the importance of the dentition to overall attractiveness. Carefully planned and well-executed orthodontics can also enhance facial appearance, which in turn has been linked to improved social skills, greater desirability, higher intellectual ability and enhanced occupational prospects (Shaw *et al.*, 1979).

Deviation from occlusal norms may leave children susceptible to harassment, teasing and bullying, with obvious psychosocial implications (Shaw *et al.*, 1980; Seehra *et al.*, 2011). Consequently, orthodontic treatment may have significant psychosocial benefits (Shaw *et al.*, 1980; O'Brien *et al.*, 2003) and can often lead to improved oral health-related quality of life. Similarly, combined orthodontic-surgical treatment has been linked to notable enhancement of both self-esteem and quality of life (Arndt *et al.*, 1986).

The undoubted benefits of orthodontics are, however, reliant on careful diagnosis, planning and management. Clinical assessment and radiographic analysis are central to the formulation of appropriate treatment decisions leading to the best aesthetic and functional outcome from treatment.

As in any other area of medicine or dentistry, to reach a diagnosis in orthodontics requires a thorough history, examination and special tests. A comprehensive history should be undertaken to clarify the motivation for treatment, the dental and orthodontic history, and any

relevant medical history that might impact on the provision of orthodontic treatment (Patel *et al.*, 2009).

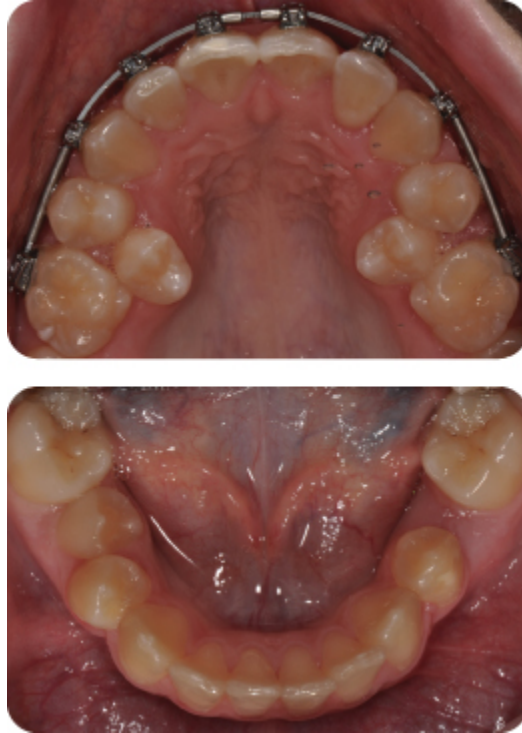
Dental History

A history of dental attendance is relevant in relation to caries experience and the presence of restorations. Caries experience is the best predictor of future caries. Poor oral hygiene predisposes to two risks of treatment: gingivitis and demineralization. Premature loss of primary teeth due to caries may also have consequence for the developing dentition. In particular, early loss of primary teeth may hasten or retard eruption of permanent teeth and lead to space loss, which can result in centre line discrepancies or potential tooth impaction.

What Has Led to Crowding of the Second Premolars in [Figure 1.1](#)?

Early loss of the second primary molars has allowed the first permanent molars to drift forward in the dental arch. The second premolars are most vulnerable to space loss in this region.

[**Figure 1.1**](#)



Restorations

Heavily-restored teeth may pose problems in relation to bonding, necessitating alteration of the bonding protocol, with sandblasting of amalgam and precious metal restorations proven to enhance bond strength (Zachrisson *et al.*, 1995; Büyükyilmaz *et al.*, 1995). There is conflicting evidence in relation to the susceptibility of root canal-treated teeth to root resorption during treatment. Nevertheless, the health of root-treated teeth should be monitored throughout treatment.

Trauma

A history of trauma to the dentition should be investigated. Previously traumatized teeth risk loss of vitality irrespective of orthodontic treatment. This potential eventuality should be discussed at the outset as part of the informed consent process. In addition, traumatized teeth may also be at risk of undergoing more apical root resorption during treatment.

The nature and timing of the traumatic injury has a bearing on further treatment (Kindelan *et al.*, 2008) ([Table 1.1](#)).

[Table 1.1](#) Timing of further treatment for traumatic injury

Type of injury	Recommended observation period before orthodontic treatment
Fracture without pulpal involvement	3 months
Subluxation	3 months
Extrusive luxation	3 months
Minor lateral luxation	3 months
Moderate/severe lateral luxation	1 year
Intrusion	1 year
Avulsion	1 year

Previous Orthodontics

Increasingly, potential orthodontic patients, particularly adults, may have undergone previous treatment. Details of the original malocclusion may help to decipher the aetiology of both the presenting and residual malocclusion. Potential consequences of incomplete treatment include residual malalignment and spacing, traumatic overbite, residual overjet, crossbite and relapse. Previous failure to complete a course of orthodontic treatment may raise questions with respect to compliance (Murray, 1989). Where compliance is questionable, it may be inadvisable to embark on an ambitious course of orthodontic treatment.

Furthermore, contemporaneous records are important to reveal deleterious effects of the primary phase. Rarely, significant root resorption may limit the feasibility for retreatment.

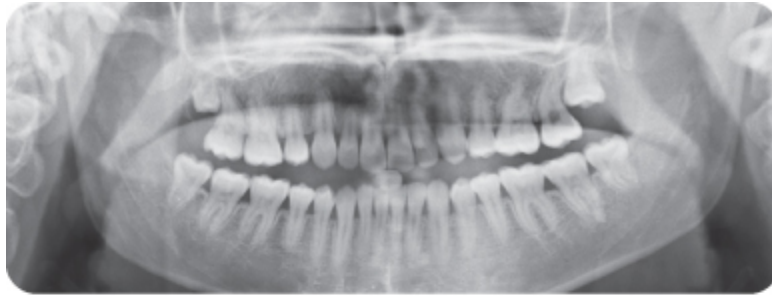
CASE 1.1

This 17-year-old female presented with a class III malocclusion on a moderate skeletal class III pattern with an average lower facial height. She has had previous orthodontic treatment to align her maxillary teeth, involving extraction of maxillary first premolars. She remains concerned in relation to her facial appearance and occlusion.

What Do You Notice with Respect to the Radiographic Appearance of the Maxillary Incisors ([Figure 1.2](#))?

The maxillary incisors, particularly the UR1, UL1 and UR2, have experienced extensive root resorption during the first phase of treatment.

[Figure 1.2](#)



How Will This Finding Influence Further Management?

The patient is keen to undergo combined orthodontic-surgical treatment to address her malocclusion comprehensively. Prior to instituting such treatment, the patient will be counselled in relation to the likelihood of further resorption. If the patient opts to undergo combined treatment, attempts will be made to avoid an upper fixed appliance. If an appliance is to be placed, light forces will be applied, there will be a premium on excellent oral hygiene and the duration of treatment will be necessarily short with realistic objectives.

Family History

The contribution of genetic factors to malocclusion has been established in family and twin studies. Concordance of occlusal patterns in monozygotic twins provides support for the influence of genetics on malocclusion, while discordance between monozygotic twins suggests occlusal relationships may be under greater environmental influences. A family history of severe class III malocclusion; abnormalities of tooth number and form; and ectopic dental development should be considered when planning treatment for relatives.

Cranio-facial morphology in class II and class III groups tends to have strong heritability, although the association is less clear in class I subjects. In particular, familial cephalometric studies have shown that mandibular length may be reduced, with a smaller mandibular body and retruded mandible in class II patients (Harris, 1975).

Furthermore, mandibular prognathism in monozygotic twins is six times higher than among dizygotic twins (Litton *et al.*, 1970). A Japanese study showed that 70% of patients undergoing orthognathic surgery for class III malocclusion have a first-degree relative with mandibular prognathism (Watanabe *et al.*, 2005). Therefore, a history of orthognathic intervention in a family member should be considered when planning early treatment and anticipating future growth in class III malocclusion.

There is also a familial link in relation to supernumerary teeth. Inheritance does not follow a simple Mendelian pattern, being variously described as an autosomal dominant trait with incomplete penetrance, a sex-linked trait and an autosomal recessive trait with lesser penetrance in females (Fleming *et al.*, 2010). Hypodontia has also been linked to specific mutations related to *MSX1* and *PAX9* genes, and tends to co-exist with microdontia (Brook, 1984). Genetic factors are also implicated in palatal

impaction of maxillary canines; dental transpositions; infra-occlusion of primary molars; and impaction of first permanent molars.

Genetic susceptibility to severe root resorption during orthodontic treatment has also been attributed to mutations of genes encoding interleukin-1 beta (IL-1 β). Consequently, the potential for extensive resorption should be anticipated in family members. Treatment objectives may be modified accordingly.

Medical History

A comprehensive medical history should be taken for each patient. Whilst there are few medical conditions that contraindicate orthodontic treatment in a compliant dentally fit individual, several can impact on the delivery of care.

Heart Defects with Risk of Infective Endocarditis

Infective endocarditis is a rare cardiac condition with mortality rates of up to 40%. Previously, antibiotic prophylaxis was recommended for patients with structural heart defects predisposing to formation of valvular vegetations, which may culminate in infective endocarditis. High-risk conditions include previous infective endocarditis, prosthetic heart valves and acquired valvular disease with stenosis or regurgitation. However, under new National Institute of Health and Clinical Excellence (NICE) guidelines in the UK, the use of prophylactic antibiotics is no longer recommended for dental procedures (NICE, 2008).

Is Antibiotic Cover Required Prior to Any Orthodontic Procedure?

Historically, antibiotic cover has been recommended for dental procedures involving gingival manipulation on patients with structural defects of the heart. The rationale for use of antibiotics was to counteract transient bacteraemia that may lead to infective endocarditis. Susceptible orthodontic procedures included placement of separators and bands, and removal of appliances. However, NICE now advises that use of prophylactic antibiotics is not indicated (NICE, 2008). The cost-efficacy of prophylaxis is unproven. The use of antibiotics has a reported attendant morbidity with fatal anaphylaxis of up to 12-25 cases per million (Ahlstedt, 1984). This risk is thought to outweigh the benefits of their use. Therefore, in current practice, antibiotic cover is not routinely recommended for patients with a structural heart defect undergoing orthodontic treatment.

Bleeding Disorders

Conditions such as haemophilia do not preclude orthodontic treatment; however, treatment should involve haematological input. These patients are also at higher risk of carrying blood-borne viral infections, including HIV or hepatitis.

CASE 1.2

This 15-year-old male presented with haemophilia A. He has mild crowding of both arches and is anxious to have orthodontic treatment ([Figure 1.3](#)).

[Figure 1.3](#)