An Exploration of the Periodontal-Orthodontic Alliance

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By

Girish Suragimath,
Kirti Anil Shetgaonkar,
A. Siddhartha Varma,
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and Ashwinirani SR

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I dedicate this textbook to my wife, Dr Ashwini Rani and my lovely daughters, Disha and Anusha, for being part of my life and inspiring me to do better in all areas. I also dedicate this work to my students and wish them success in all their life endeavors.

Dr Girish Suragimath

I want to dedicate this textbook to my family, who supported me throughout my journey. Warm gratitude to my parents, Anil and Sarita Shetgaonkar, for raising me to believe anything is possible, and my brother, Anay, and fiancée, Mayuresh Desai, for their endless patience and support. I would like to thank my post-graduate guide Dr Girish Suragimath, for imparting his skills and values and teaching me that determination is nothing without dedication and hard work.

Dr Kirti Anil Shetgaonkar

I wish to dedicate this textbook to my wife, Dr Rashmi Varma, my son, Advait, and my parents, Dr A. S. Raju and A. Uma. I wish to thank them for their love, dedication, and support.

Dr Siddhartha Varma

I want to thank the almighty, dedicate the book to my family, and give warm gratitude to my parents, Dr Anil and Mrs Nilima, my wife, Dr Charushila, and my brother, Dr Rakesh, for their love and support.

Dr Sameer Zope

I dedicate this textbook to my parents, Mrs Gajagowri and Mr C. Renukaradhya, and my children, Disha and Anusha, for supporting me. I thank God for guiding and enlightening me throughout my journey.

Dr Ashwinirani SR

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FOREWORD

The textbook, *An exploration of the Periodontal-orthodontic Alliance*, provides the readers with a comprehensive reference of literature on the multidisciplinary approach to orthodontic and periodontic relationships. The book includes detailed chapters explaining periodontal, orthodontic integration, periodontal tissues and orthodontic forces, periodontics as an adjunct to orthodontic therapy, orthodontics as an adjunct to periodontal treatment, periodontal surgeries aiding in accelerated orthodontic therapy, functional periodontal surgeries helping in orthodontic treatment, periodontal surgeries for aesthetics in orthodontic treatment, implant surgeries for orthodontic anchorage, periodontal considerations in clear aligners, and orthodontic considerations in periodontally compromised patients.

I congratulate all the authors and wish them all the best.

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PREFACE

The book *An Exploration of the Periodontal-orthodontic Alliance* aims to provide readers with detailed information regarding the interdisciplinary approach to orthodontic and periodontic relationships. The book will help dental students, practitioners, and researchers to gain insight into the interdisciplinary approach to orthodontics and periodontics and support dental patients.

In this context, this book was planned and designed to focus on the periodontal-orthodontic interrelationship approach. The book provides information on skills that are mandatory to explain the procedures, reasons, and goals for each step. According to this approach, students and professionals can understand the rationale and work with specific strategies and aims.

Dr Girish Suragimath

INTRODUCTION

Periodontics and orthodontics have an interdependent relationship. The periodontium is the basis for the tooth movements achieved in orthodontic therapy; they are the resilient structures through which tooth movement can be achieved. Periodontics provides the necessary treatment, which aids in the retention of the orthodontic tooth movement. Periodontal surgical procedures aid in flap reflection and the exposure of impacted teeth for orthodontic tooth movements. Periodontal plastic surgeries are needed for the maintenance of an adequate attached gingiva and for aesthetics to give a better smile to the patients. Periodontal surgery, like Periodontally Accelerated Osteogenic Orthodontics (PAOO), accelerates orthodontic tooth movement. Orthodontics adjuncts periodontology by vertical repositioning the tooth which can help to correct certain osseous defects. In the case of open gingival embrasures, orthodontic therapy can help to regain the lost papilla if the causative agent is defective angulation of the tooth or divergent roots. For patients who exhibit drifted adjacent teeth to an edentulous site, orthodontic therapy can be done as a pre-implant placement procedure to correct the same. Orthodontic therapy benefits the correction of crowded teeth, which helps to maintain oral hygiene. Thus, both branches, periodontology and orthodontics, are interrelated whilst achieving their individual goals.

LIST OF ABBREVIATIONS

CAD/CAM	Computer-Aided Design/Computer-Aided Manufacturing
TMJ	Temporomandibular Joint
CSF	Circumferential Supracrestal Fibrotomy
TMD	Temporomandibular Disorders
PAOO	Periodontally Accelerated Osteogenic Orthodontics
PDL	Periodontal Ligament
OTM	Orthodontic Tooth Movement
GO	Gingival Overgrowth
GI	Gingival Ingrowth
MMP	Matrix Metalloproteinase
GR	Gingival Recession
GBR	Guided Bone Regeneration
RANK	Receptor Activator of Nuclear Factor-Kappa
RANKL	Receptor Activator of Nuclear Factor-Kappa-B Ligand
OPG	Osteoprotegerin
3D	3-dimensional
ATP	Adenosine Triphosphate
NSPT	Nonsurgical Periodontal Therapy
OPI	Orthodontic Plaque Index
PIOP	Plaque Index for Orthodontic Patients
RAP	Regional Acceleratory Phenomenon
PTH	Parathyroid Hormone
DO	Distraction Osteogenesis
AAO	Accelerated Osteogenic Orthodontics
OPG	Orthopantomogram
IOPA	Intra Oral Peri Apical
Er, Cr:YSGG	Erbium, chromium-doped yttrium, scandium, gallium, and garnet
LAFC	Laser-Assisted Flapless Corticotomy
LLLT	Low-Level Laser Therapy
NdYAG	Neodymium-doped Yttrium Aluminum Garnet

Er:YAG	Erbium: yttrium-aluminum-garnet
CO2	Carbon Dioxide
TAD	Temporary Anchorage Devices
MGJ	Mucogingival Junction
AG	Attached Gingiva

CHAPTER 1

PERIODONTAL, ORTHODONTIC INTEGRATION

DR GIRISH SURAGIMATH
DR KIRTI ANIL SHETGAONKAR
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Introduction

This chapter independently introduces the periodontics and orthodontics branches and then describes the adjunctive relationship. The periodontal aspect aids in the retention of the orthodontically treated teeth; it aids in accessibility to the underlying malposed teeth by raising a full-thickness flap and subsequent orthodontic extrusion. The periodontal aspect provides various mucogingival surgeries that help to maintain the width of the attached gingiva. The benefit of orthodontic forces on periodontal tissue is commendable. The vertical repositioning of the tooth can help to correct certain osseous defects. In the case of open gingival embrasures, orthodontic therapy can help to regain the lost papilla if the causative agent is a defect in the angulation of the tooth or divergent roots. For cases that exhibit drifted adjacent teeth to an edentulous site, orthodontic therapy can be carried out as a pre-implant placement procedure to correct the same. Orthodontic therapy benefits the correction of crowded teeth, which helps to maintain oral hygiene. The current chapter intends to highlight the effect of orthodontic forces on periodontal tissues, the protective role of orthodontic treatment against periodontal breakdown, periodontics as an adjunct to orthodontic therapy, periodontal surgery intended to accelerate the orthodontic tooth movement, orthodontics as an adjunct to periodontal therapy, gingival discrepancies which can be treated by orthodontic therapy, osseous defects which can be treated by orthodontic therapy, periodontal surgery to retain the orthodontic tooth movement, and the relationship between orthodontic treatment and oral hygiene.

1.1 Field of dentistry

Dentistry is a branch of medicine that involves the study, diagnosis, prevention, and treatment of conditions, diseases, and disorders of the oral and maxillofacial region, including the adjacent associated structures. It consists of nine branches: Prosthodontics, Crown and Bridge, Periodontology, Oral and Maxillofacial Surgery, Conservative Dentistry and Endodontics, Orthodontics and Dentofacial Orthopedics, Oral and Maxillofacial Pathology and Oral Microbiology, Public Health Dentistry, Pediatric and Preventive Dentistry, Oral Medicine and Radiology.

1.1.1 Dentistry and its branches

The branch of oral medicine and radiology deals with the diagnosis and nonsurgical management of pathosis arising from the jaws, oral mucosa,

para oral structures, oral manifestations of systemic diseases and management of medically compromised patients, clinical case history recording, radiographic investigation, diagnosing and determining an apt treatment plan. The treatment of restoring carious teeth and root canal treatment of endodontically involved teeth are carried out in the department of Conservative dentistry and Endodontics. Removal and fixed prosthesis are designed and fabricated in Prosthodontics, Crown and bridge departments to rehabilitate the edentulous areas. The department of Pedodontics manages the dentition and oral issues of pediatric patients. The oral and maxillofacial surgery department handles dental infections, pathologies, maxillofacial trauma, and facial pain.

All branches of dentistry are interlinked and interdependent for achieving the optimal treatment goal and rendering the best treatment to the patients. In several cases, this calls for an interdisciplinary approach involving different branches of dentistry. The various branches of dentistry and their descriptions are provided below, and the schematic representation is given in figure 1.1.

(i) Prosthodontics, Crown and Bridge: A branch of dental art and science pertaining to the restoration and maintenance of oral function, health, comfort, and appearance by the replacement of mission or lost natural teeth and associated tissues either by fixed or removable artificial substitutes.[1]

(ii) Periodontology: Periodontology is the science dealing with the health and diseases of the investing and supporting structures of the teeth and oral mucous membrane.[1]

(iii) Oral and Maxillofacial Surgery: Oral and Maxillofacial Surgery deals with the diagnosis and surgical and adjunctive treatment of diseases, injuries, and defects of the human jaw and associated oral and facial structures.[1]

(iv) Conservative Dentistry and Endodontics: Conservative dentistry deals with the prevention and treatment of the diseases and injuries of the hard tissues and the pulp of the tooth and associated periapical lesions, along with restoration of those teeth to normal form, function and aesthetics.[1]

(v) Orthodontics and Dentofacial Orthopedics: Orthodontics and Dentofacial Orthopedics deal with the prevention and correction of oral anomalies and malocclusion and the harmonizing of the structures involved so that the dental mechanisms function in a normal way.[1]

(vi) Oral and Maxillofacial Pathology and Oral Microbiology: Oral and Maxillofacial Pathology and Oral Microbiology deal with the nature of oral diseases, their causes, processes, and effects. They relate the clinical manifestation of oral diseases to the physiologic and anatomic changes associated with these diseases.[1]

(vii) Public Health Dentistry: Public Health Dentistry is the science and art of preventing and controlling dental diseases and promoting dental health through organized community efforts.[1]

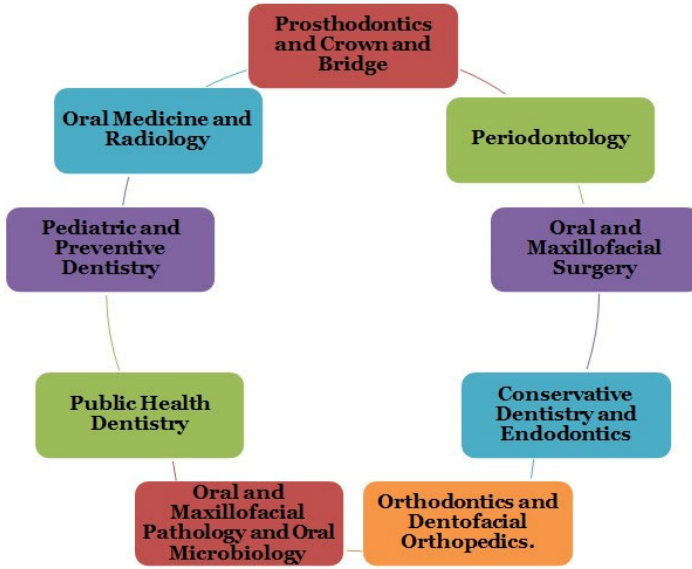
(viii) Pediatric and Preventive Dentistry: Pediatric and Preventive Dentistry deals with preventing and treating oral and dental ailments that may occur during childhood.[1]

(ix) Oral Medicine and Radiology: Oral Medicine is a specialty of dentistry concerned with the primary diagnostic procedures and techniques used in recognizing the diseases of the oral tissues of local and constitutional origin and their medical management. Radiology is a science dealing with x-rays and their uses in the diagnosis and treatment of diseases concerning orofacial diseases.[1]

1.2 Periodontology or Periodontics

The term periodontology or periodontics is derived from the Ancient Greek, “περί”, “perí” that means “around”; and “ὀδούς”, “odoús” that means “tooth”. Periodontology is the specialty of dentistry dealing with supporting structures of the teeth, as well as diseases and conditions that affect them.[2]

Figure 1.1: Different branches of Dentistry



1.2.1 Definition

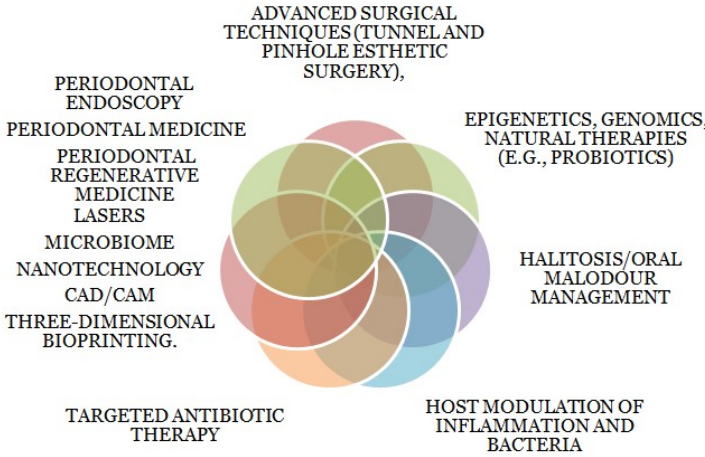
According to the Glossary of Periodontal Terms (2001), periodontics is defined as "That specialty of dentistry which encompasses the prevention, diagnosis, and treatment of diseases of the supporting and surrounding tissues of the teeth or their substitutes; the maintenance of the health, function, and aesthetics of these structures and tissues; and the replacement of lost teeth and supporting structures by grafting or implantation of natural and synthetic devices and materials".[3]

1.2.2 Aim and objectives

The periodontology branch aims to preserve, improve, restore, and maintain the attachment apparatus, the periodontium, the teeth, the dental implants, and the peri-implant tissues to achieve health, functions, and aesthetics. Periodontology encompasses halitosis/oral malodor, host modulation of inflammation and bacteria, host versus pathogens in the pathogenesis of periodontitis, periodontal medicine, periodontal regenerative medicine, personalized (precision) periodontics, advanced surgical techniques (tunnel

and pinhole aesthetic surgery), epigenetics, genome-wide association studies, genomics and other "omics" technology (e.g., proteomics, degradomics, etc.), inflammaging (increased inflammation with age), inflammasome, lasers, microbiome, nanotechnology, CAD/CAM, three-dimensional bioprinting, natural therapies (e.g., probiotics, fish oil, ayurvedic medicine, etc.), periodontal endoscopy, polymicrobial synergy, and microbial dysbiosis: keystone pathogen hypothesis, targeted antibiotic therapy (Figure 1.2).

Figure 1.2: Procedures included in Periodontology



1.2.3. Periodontal treatment phases

According to Carranza, the periodontal treatment plan involves the emergency phase, the nonsurgical phase, the evaluation of response to the nonsurgical phase, the surgical phase, restorative phase, and maintenance phase.[4]

1.2.3.1 Treatment plan by Carranza (Figure 1.3)

Emergency phase

The emergency phase is also called the “preliminary phase”. It includes the treatment of emergencies such as the drainage of periodontal or periapical abscess; and the extraction of hopeless teeth.

Phase I (Nonsurgical)

This phase is also called the etiotrophic or cause-related phase. It includes habit cessation counselling, diet control (in patients with rampant caries), removal of calculus and root planing, correction of restorative and prosthetic irritational factors, excavation of caries, and restoration (temporary/final, depending on prognosis and the location of caries), antimicrobial therapy (local/systemic), occlusal therapy, minor orthodontic movement, provisional splinting and prosthesis.

Phase II (Surgical phase)

Phase II therapy includes surgical phase therapy. The surgical treatment model is employed when the nonsurgical mode of treatment does not improve disease cessation. It includes periodontal therapy, placement of implants, and endodontic therapy.

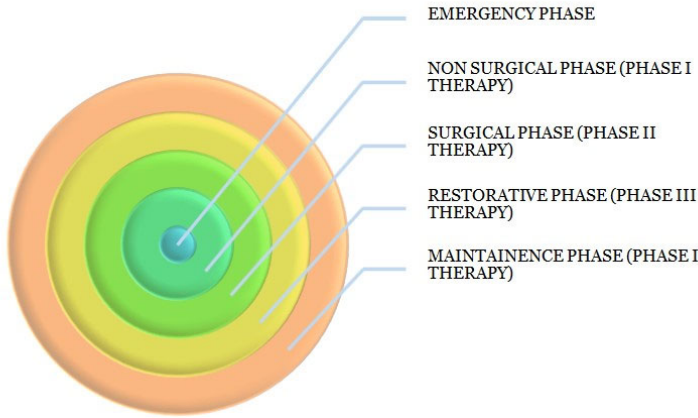
Phase III (Restorative phase)

This includes final restorations, fixed and removable prosthodontic appliances, evaluation of response to restorative procedures, and periodontal examination.

Phase IV (Maintenance phase)

The maintenance phase is also known as supportive periodontal therapy. It consists of periodic rechecking of plaque and calculus, gingival inflammation, pockets, occlusion, tooth mobility, and other pathologic changes.

Figure 1.3: Periodontal treatment plan by Carranza



1.2.3.2 Treatment plan by Lindhe (Figure 1.4)

The treatment plan by Lindhe et al. includes the following phases:

- Systemic phase of periodontal therapy:

The systemic phase is the first phase of treatment planning. It consists of habit cessation counselling and medical management of the systemic disease and conditions of the patient. The main goal of the systemic phase is to eliminate or decrease the influence of systemic conditions on the outcome of therapy. It aims to protect patients and dental care providers against infectious hazards.

- Initial phase of periodontal therapy:

This phase is also known as cause-related therapy or the hygiene phase of periodontal treatment. It aims to render the oral cavity clean and infection-free. Its intention is optimal plaque control by scaling root planning and motivating the patients for compliance. This phase includes the re-evaluation and planning of additional and supportive measures.

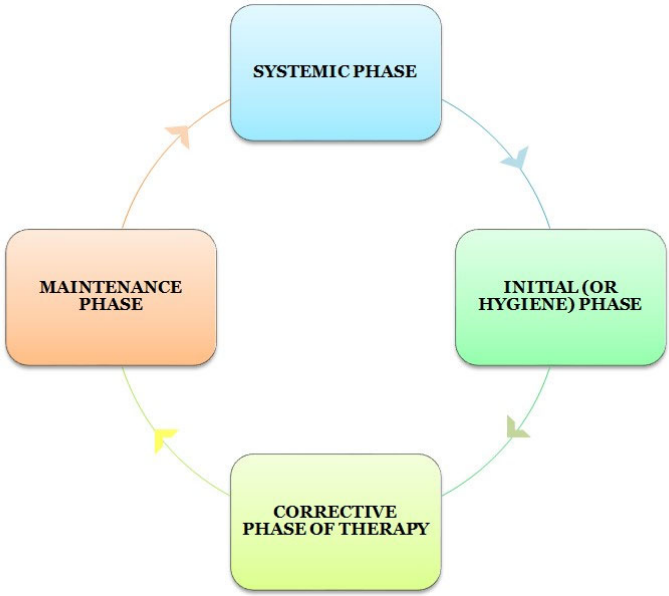
- Corrective phase of periodontal therapy:

This phase addresses the sequel of opportunistic infections, including therapeutic measures such as periodontal flap surgery and, implant surgery, or endodontic therapy. The amount of corrective treatment is determined after evaluating the degree of success of cause-related therapy.

- Maintenance phase (care):

This phase is supportive periodontal therapy that aims to prevent reinfection and disease recurrence. The recall system for each patient is designed individually according to the assessment of deepened sites with bleeding on probing, instrumentation of such sites, and fluoride application to prevent dental caries.[6]

Figure 1.4: Periodontal treatment plan by Lindhe



1.2.3.3 The Trimeric Model of Periodontal Treatment

This model involves the standard phases of treatment representative according to its number. The difference in periodontal treatment is that it is in stages (phases) that are centered and aimed toward the maintenance phase (Phase IV), which is the final aim of periodontal therapy. The phases of periodontal treatment are followed by a re-evaluation phase, in which a decision is arrived at on the next treatment step. Figure 1.5 depicts the Trimeric Model of Periodontal Treatment Planning.

Figure 1.5: The Trimeric Model of periodontal treatment planning