To my wife, Doris, my children, Lucas and Ana Clara, and my parents, Zelia and Henrique.

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TREATMENT PLANNING

in Restorative Dentistry and Implant Prosthodontics

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Contents

Preface

Treatment planning is commonly considered one of the most important phases of any dental treatment and vital for achieving successful long-term results. Despite its importance, the process of planning a treatment, particularly in restorative dentistry, can be somewhat confusing and divisive. There are multiple reasons for this. First of all, most dental schools do not offer courses exclusively designed for comprehensive planning. In predoctoral and postdoctoral programs alike, treatment planning is commonly taught as a part or content of a specific discipline, such as prosthodontics, periodontics, occlusion, orthodontics, or oral surgery. Second, there is a lack of proper literature on the subject. Much has been written about treatment planning, but on close examination nearly all articles and texts fail to be as objective, clear, comprehensive, and clinically oriented as they claim to be. Although nearly every author attempts to discuss the subject in a comprehensive fashion, in the end they all tend to concentrate their considerations more heavily toward their individual area of expertise. Consequently, when the dental student or the practitioner is faced with treatment planning for the total individual, especially complex full-mouth reconstruction cases, he or she is forced to consult multiple textbooks and articles, each of which explores only a portion of the totality. Eventually, there is always doubt about how to put all the information together and determine what needs to be done first.

For the reasons mentioned above, planning for the total individual has turned out to be a great challenge. Not only can it be a vague goal but also a difficult skill for dental students and dentists to acquire. Moreover, comprehensive planning is rarely discussed in scientific meetings and conferences because participants (according to most meeting organizers) are expected to have attained information on the subject during their training in dental school, given that treatment planning is commonly regarded as a basic topic. Without proper knowledge and with very few options left to learn the subject, practitioners are forced to use their intuition to solve problems, which is highly unpredictable.

The demand for a philosophy of total care in treatment planning is higher than ever with our current emphasis on predictability, reliability, and successful long-term results. The frustration and looks of despair on the faces of my students and the difficulties encountered by so many dentists when faced with the necessity to solve complicated cases without having a clue as to what to do or which direction to go inspired me to write this book. In it, I present clinical guidelines for planning treatments in restorative dentistry and outline a clear, objective, and simple thinking process that can be easily applied in daily practice. The book is intended to assist the student of dentistry at every level as well as the general practitioner and restorative dentist in the development of a comprehensive and accurate plan of care for the adult patient. With particular attention given to the interrelationship between different specialties to enhance data correlation and collaboration, all specialists have something to gain as well. A philosophy for a systematic and consistent manner to diagnose and solve clinical problems is presented, and the methodology is so simple that any practitioner can follow along. The text includes the entire planning process with its most important phases. All planning phases are presented in an easy-to-follow, step-by-step format, providing the reader with a roadmap to be used as a reference from the very initial procedures until final restorative treatment. Each phase is carefully described, and the most important topics are listed and discussed, always following scientifically sound evidence-based data and in accordance with ethical and legal principles. Special emphasis is placed on planning procedures for implant dentistry, particularly on the examination of edentulous areas and proper selection of prosthetic modalities for replacing missing dentition.

The contents of the book are presented in three parts, starting with the introduction of the methodology and extending from the first appointment all the way to the stage in which treatment plans are presented and informed consent is obtained from the patient. All stages are progressively covered in a sequence that facilitates clinical application. The introductory

chapter provides the rationale for developing a philosophy of total care and the potential benefits of devising a protocol for the establishment of a comprehensive and efficient plan of care. It also details how the method works, highlighting its principles, planning phases, and clinical application.

Part One describes how to identify existing problems by gathering, organizing, and analyzing information obtained during clinical examination. Special emphasis is placed on the methodology developed for diagnosing procedures that will, to a great extent, facilitate diagnosis and treatment plan development. A reliable and organized protocol to collect and record clinical data is presented, and examination checklists and forms are included for all stages of data gathering to ensure that no important information is left out during the evaluation process. This scheme increases predictability and the chances of reaching a complete and precise problem list (diagnosis) and plan of treatment.

Part Two focuses on providing solutions to identified problems via restorative treatment options, highlighting the use of implant-supported restorations in the treatment of both partially and completely edentulous arches. It also addresses ideal and alternative plans of treatment for patients with both partially and completely edentulous situations.

Part Three details how to present treatment options to the patient and includes aspects related to patient education, treatment plan presentation, and obtaining informed consent from the patient. In contemporary dentistry, the role of the dentist in presenting the treatment plan is changing from that of final authority in all decisions to that of a content expert, educator, and advisor to the patient. Therefore, it is of paramount importance that the clinician be prepared to fully inform the patient about his or her oral condition and potential treatment options.

Making a diagnosis and planning a treatment implies the professional responsibility to omit nothing of consequence for the patient; deviation from this line of thought has become unacceptable and is no longer tolerated. Therefore, there is a distinct need to teach dental students and all professionals involved with restorative procedures to fulfill their responsibility in the management of a comprehensive treatment plan for the patient, and there has long been a need for an efficient method to successfully address this issue. A philosophy providing a thought process to be used in all situations, combined with a consistent and methodical approach, would definitely increase both reliability and predictability of long-term results of the treatment as a whole. While new technology and techniques can certainly make treatment easier to execute or more efficient, the fact remains that diagnosis and treatment planning are still the primary determinants for long-term success.

I hope that this book will contribute to minimize the usual doubts concerning treatment planning. It will provide teachers, students, and practicing dentists with the fundamentals for the establishment of an effective global treatment plan, avoiding the usual pitfalls frequently encountered during this process. The scarcity of material on the topic has made writing this book a great challenge, but I hope the final product will steer you in the right direction and lead to better treatment plans for you and your patients.

Acknowledgments

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While it is impossible to list all who have directly or indirectly helped with the development of this book, the author feels most indebted to Ronald Granger, Dan Nathanson, Remo Sinibaldi, Zhimon Jacobson, Steven Morgano, John Cassis, Elton Zenobio, and Gustavo Borges for sharing their knowledge, experience, as well as personal guidance and support. The author expresses his deepest gratitude to Federico Castellucci, Giovanni Castellucci, Celeste Kong, Mauricio Cosso, Jose Alfredo Mendonça, Alexandre Eustaquio Rocha, and Marcus Guimaraes, who helped with the initial drafts. Special thanks are also given to the following dental technicians: Rolf Ankly, Juan Kempen, Nicholas Serafin, and Renata Andreotti. Acknowledgments and thanks to my students who, throughout these past 10 years, have been a constant inspiration for the completion of this project.

Writing a book definitely takes a personal toll on the author's family. During this project, my wife, Doris, and my children, Lucas and Ana Clara, bore the burden of the time and pressures for its completion. Without their unbending support, this book would not exist. Thank you for understanding and giving up our personal time.

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Chapter 1

A Rationale for Developing a Philosophy of Total Care

Controversies and Uncertainties Related to the Planning Process

Dental therapies can be divided into three phases regardless of their area and/or level of complexity: *(1)* diagnosis and treatment planning, *(2)* treatment delivery, and *(3)* control and maintenance.[1] The initial phase—diagnosis and treatment planning—is generally considered the most important phase of any dental treatment and is vital for achieving successful long-term results.[1] However, planning treatment in restorative dentistry can be confusing and difficult. Controversies and uncertainties related to the planning process have made it not only a vague goal but also a difficult skill for dental students and dentists to acquire.

In the initial phase, it is not uncommon for dentists to become puzzled and lose track of what to do to develop a comprehensive and reliable plan of care. The immense number of findings that arise when evaluating a difficult dental case (Fig 1-1) may overwhelm inexperienced practitioners to such an extent that they do not even know where to start or what to do first. Even with experienced dentists, questions such as "Now what am I supposed to do?" or "How can I be sure that all the necessary information has been properly assessed?" are quite common in this phase of treatment. Furthermore, quite frequently there is disagreement as to which specialty or professional should assume the role of organizing and conducting the complete planning process.

One reason underlying this confusion is the manner in which treatment planning is addressed in dental schools. Most schools do not offer courses exclusively designed for comprehensive planning. In predoctoral programs, treatment planning is commonly taught as a part of a specific discipline, such as prosthodontics, periodontics, occlusion, orthodontics, or oral surgery. Postdoctoral courses tend to follow the same segmented format. Because of this deficiency, there are no set guidelines to be followed by the clinician throughout the entire planning procedure, and there is a lack of understanding of what objectives need to be achieved in the complete planning process. Without a comprehensive and effective philosophy providing a course of action to be followed, dentists have been forced to rely on their own intuition to create an approach for diagnosis and treatment planning.

Many dentists tend to develop a specific method to diagnose and treat each single case. Because each patient is unique, every case must be planned considering the specific individual characteristics of that patient. Thus, the dentist is faced with the challenge of devising a specific planning method for each and every patient presenting for treatment. Furthermore, because the dentist is working without understanding what goals need to be achieved at the end of the planning process,

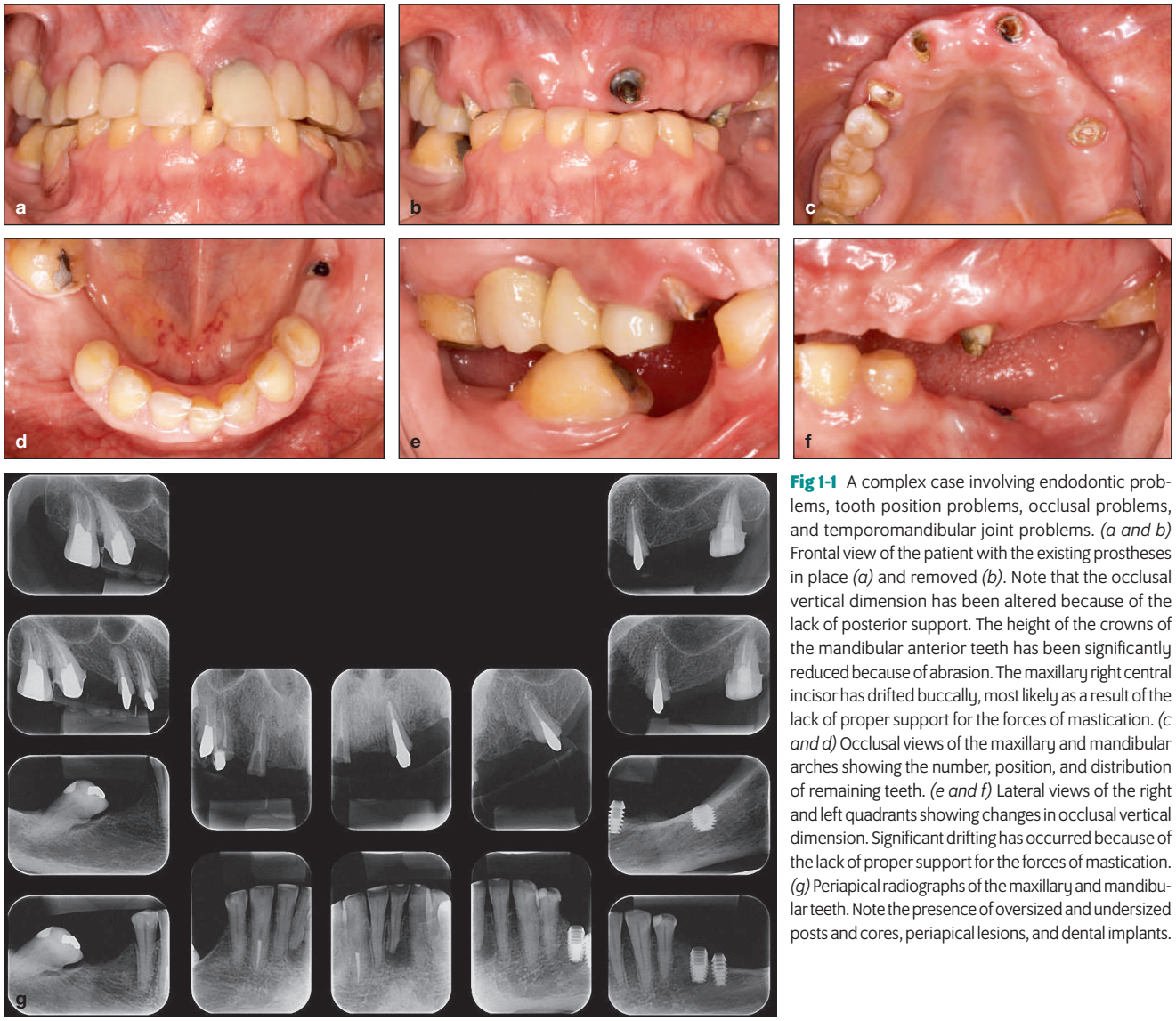


Fig 1-1 A complex case involving endodontic problems, tooth position problems, occlusal problems, and temporomandibular joint problems. *(a and b)* Frontal view of the patient with the existing prostheses in place *(a)* and removed *(b)*. Note that the occlusal vertical dimension has been altered because of the lack of posterior support. The height of the crowns of the mandibular anterior teeth has been significantly reduced because of abrasion. The maxillary right central incisor has drifted buccally, most likely as a result of the lack of proper support for the forces of mastication. *(c and d)* Occlusal views of the maxillary and mandibular arches showing the number, position, and distribution of remaining teeth. *(e and f)* Lateral views of the right and left quadrants showing changes in occlusal vertical dimension. Significant drifting has occurred because of the lack of proper support for the forces of mastication. *(g)* Periapical radiographs of the maxillary and mandibular teeth. Note the presence of oversized and undersized posts and cores, periapical lesions, and dental implants.

it is impossible to know whether these goals have been achieved or not. This line of thought can be very confusing and misleading. It would be much easier to use the same thought process in all situations. This would certainly facilitate treatment planning procedures because the same protocol could be used for every patient irrespective of his or her clinical condition. It would also improve the communication between dental professionals when discussing any given case.

Another concern points to the lack of proper literature on the subject. Much has been written about treatment planning, but despite most authors' efforts to address the topic in a complete manner, on close examination nearly all articles and texts fail to be as objective, clear, comprehensive, and clinically oriented as they claim to be. Although nearly every author attempts to discuss the subject in a comprehensive fashion, in the end they all tend to concentrate their considerations more heavily toward their individual area of expertise. Even the establishment of an interrelationship between different topics within the same specialty is frequently overlooked. For example, consider the examination of articulated casts in restorative dentistry. In general, students know that it is important to mount study casts on an articulator; but once this has been accomplished, occlusion tends to be the center of attention, and other areas of similar importance such as the evaluation of edentulous areas are left without proper consideration, and a complete examination of the mounted casts is frequently not conducted. Similarly, textbooks on occlusion, fixed partial dentures, removable partial dentures, and complete dentures tend to discuss treatment planning on the basis of each individual subject without associating

Box 1-1

Factors that contribute to controversy and confusion in treatment planning

- Lack of guidelines to use as a reference throughout the entire planning process
- Lack of set objectives to accomplish
- Massive amount of information to assess
- Inadequate organization of collected data
- Question as to who should be responsible for the entire planning process

these individual discussions with the specialty at large. Consequently, when the dental student or the practitioner is faced with treatment planning for the total individual, especially complex full-mouth reconstruction cases, he or she is forced to consult multiple textbooks and articles, each of which explores only a portion of the totality. Eventually, there is always doubt about how to put all the information together and determine what needs to be done first.

Moreover, comprehensive planning is rarely discussed at scientific meetings and conferences because participants (according to most meeting organizers) are expected to have attained information on the subject during their training in dental school, given that treatment planning is commonly regarded as a basic topic.

Without a doubt, dentists' inability to precisely determine what objectives need to be achieved in the complete treatment planning process can be considered a major setback. Box 1-1 outlines the factors that contribute to this problem.

Historical Overview of Planning Methods

To better understand current treatment planning concepts, one should become familiar with how treatment planning decisions have been made in the past, the apparent limitations of that process, and how clinical decision-making was affected by traditional models. Box 1-2 summarizes the main differences between traditional and contemporary planning concepts.

Traditional planning concept

In the past, dental treatment consisted of the relief of pain, the resolution of esthetic issues, or the replacement of missing teeth.[2] The treatment was performed with the intent to solve a specific problem or by focusing on a specific area commonly related to the problem described by the patient. Typically,

Box 1-2

Traditional versus contemporary planning concepts

Traditional concept
- *Empirically based*
- Treatment focused on solving a specific problem
- Segmented care
- Poor long-term prognosis

Contemporary concept
- *Evidence based*
- Treatment focused on the patient as a whole
- Comprehensive care
- Good long-term prognosis

a specific tooth condition or problem was evaluated, and an immediate recommendation was then made about what should be done to solve that problem. This was all it took for the practitioner to gain a measure of consent from the patient to begin treatment. The solution to the given problem was generally quite simple. Treatments were performed based on the diagnostic capabilities and limited to the therapeutic modalities available at the time. Treatment decisions were made in an environment of uncertainty, and treatment recommendations were usually based on the dentist's experience, which was most often empirically based, without solid scientific foundation. This concept of treatment proved to be inefficient and, at times, detrimental to the patient, especially on a long-term basis, when it simply offered a segmented type of care in which only one tooth, quadrant, or arch was treated without any concern for the patient as a whole. Also, it was not unusual for the patient to pass on treatment decisions to the dentist, expressing sentiments such as "Just do what you think best" or "What would you do if I were your father or mother?"

In this kind of scenario, dentists were the only ones to decide the type of treatment to be delivered to the patient, and often a clearly articulated diagnosis was hard to reach. Even in those cases in which the dentist made a mental judgment on the treatment rationale, the diagnosis might not have been stated to the patient. As a result, it was highly unlikely that patients would be presented with treatment options; even when options were presented, the offerings tended to be unthinking, with the patient given minimum information with which to make a thoughtful decision. Therefore, in these circumstances, the treatment plan essentially served as *(1)* a means of collecting fees (formal document) and *(2)* a general orientation for delivering therapeutic measures.

Traditional models also do not lead to successful outcomes because of the manner in which the information is assessed

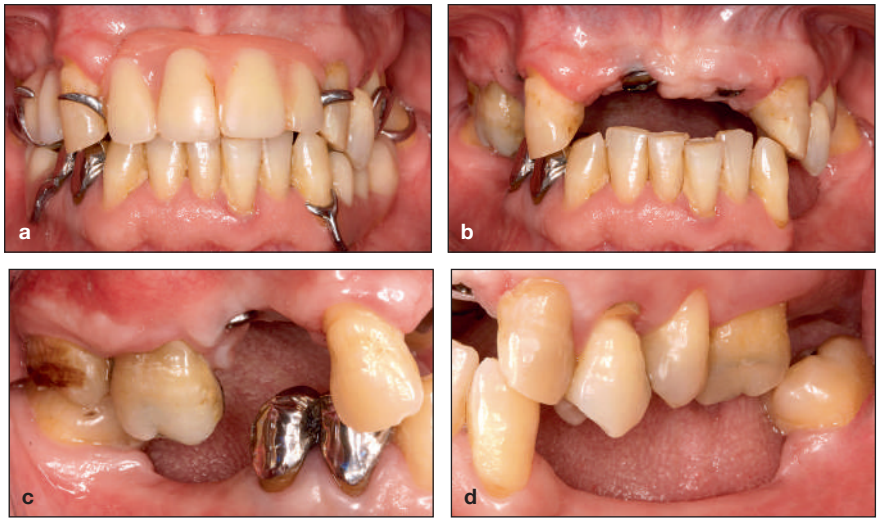


Fig 1-2 *(a)* Frontal view showing the maxillary arch with a removable partial denture replacing the missing anterior teeth. *(b)* Frontal view showing the reduced vertical prosthetic space and implants in the anterior maxilla. *(c and d)* Lateral views of the right and left posterior quadrants showing missing posterior teeth as well as extrusion of teeth opposing the edentulous spaces. Altered occlusal vertical dimension can also be noted.

and organized in different stages of treatment planning. Generally, the primary planning steps include initial consultation with patient interview, initial clinical examination, preliminary impressions for study casts, and assessment of diagnostic aids (radiographic examination and evaluation of articulated casts). After data gathering, the collected information is assessed, and the treatment plan is finalized. In theory, this process appears to be adequate, but when it comes to clinical application, it seems not to work. The system by itself does not offer guidelines for managing diagnosis and treatment planning procedures in a comprehensive manner, particularly in more complex cases, and it does not encourage a discussion correlating findings from different areas of expertise either. As a result, the evaluation procedures become segmented and fail to be comprehensive. Figures 1-2 and 1-3 illustrate clinical situations in which emphasis was given to resolving a specific problem without paying attention to other important issues, potentially resulting in compromised treatment longevity.

Case 1

The patient in Fig 1-2 presented for initial examination to a different dentist complaining about the poor esthetics and function of his maxillary removable partial denture and asked to have it replaced by an implant-supported restoration (see Fig 1-2a). In an attempt to meet the patient's expectations, this dentist placed two implants in the anterior maxilla (see Fig 1-2b). However, this dentist did not pay attention to other important considerations, such as the reduced vertical prosthetic space in the anterior maxilla, the reduced number of posterior teeth, the altered plane of occlusion, and the altered occlusal vertical dimension (see Figs 1-2c and 1-2d), which may explain the loss of the previous dentition. Unless a complete examination is carried out and all existing additional problems are resolved, the future implant-supported prosthesis replacing the missing anterior teeth may be subjected to excessive occlusal forces and fail just like the previous dentition did.

Case 2

The patient in Fig 1-3 presented for examination complaining about the mobility of the implant-supported restoration installed in the maxillary left posterior quadrant. During the initial consultation with the previous treating clinician, the patient had requested implant treatment for the rehabilitation of this edentulous segment. That was all it took for the previous dentist to schedule surgery and place the implants. Again, treatment was provided to solve a specific patient request without conducting a more complete analysis to investigate other potential problems.

The patient's crossbite (see Fig 1-3a) and the extrusion of the mandibular left second molar (see Fig 1-3d) were not taken into consideration by the previous dentist. As a result of the patient's occlusal scheme, during function transverse forces are applied to the implant prosthetics, causing screw loosening and instability of the restoration. This is another clear example of how factors other than those directly related to the patient's chief complaint and expectations may adversely interfere with or affect treatment prognosis as a whole. Ideally, a comprehensive investigation should have been carried out. The extrusion of the mandibular second molar should have been corrected before fabrication of the implant prosthetics. This would have allowed for the development of a proper occlusal plane. As a result, occlusal forces could have been better distributed, minimizing chances of biomechanical complications and failure.

Fig 1-3 *(a)* Frontal view of maxillary and mandibular arches showing a crossbite on the patient's right side. *(b and c)* Lateral views of the left and right posterior quadrants. Note that significant extrusion has occurred on the mandibular left second molar. *(d)* Lateral view of the mandibular left posterior quadrant showing significant extrusion of the mandibular left second molar. *(e)* Lateral view of the maxillary left posterior quadrant showing significant alteration of the occlusal plane caused by the extrusion of the mandibular left second molar. *(f)* Left bitewing radiograph showing the implant-supported crowns in the maxillary arch and the extruded mandibular second molar. *(g)* Frontal view of articulated study casts showing lateral excursion (left working and right balancing sides). Note the pattern of the lateral excursive movement on the right balancing side. The lack of canine guidance (because of the crossbite) causes lateral interferences to occur, affecting particularly the implant-supported restorations. This situation is made worse because of the extruded mandibular second molar. *(h)* Lingual lateral view of articulated study casts showing the extruded mandibular second molar in contact with the implant-supported restorations.

Contemporary planning concept

In modern dentistry, however, this specific problem–solving type of treatment has been replaced by a complete form of case analysis, with a singular focus on comprehensive patient care.[2] Currently, making a diagnosis and planning a treatment implies the professional responsibility to omit nothing of consequence; deviation from this line of thought has become unacceptable and is no longer tolerated. Several technologic developments in the form of new diagnostic instruments have improved the diagnostic accuracy and predictability of treatment planning. Advances made by research have made available a vast array of sophisticated treatment options improving function, esthetics, and longevity of the final treatment. Furthermore, present-day dentistry has incorporated the concept of evidence-based decision-making as an essential part of the entire treatment planning process. Such a concept entails the view that clinical decisions should be based on scientific principles and that treatment regimens must be tried, tested, and proven worthy by accurate, substantiated, and reproducible studies.

As a result of this new perspective, to date dentists are expected to be able to provide patients with thorough information about their individual problems, making available a whole range of treatment options. Patients should be prepared to make an informed treatment decision; to achieve this, first dentists should identify all existing problems or factors that may predispose to problems. The development of a problem list is an essential part of this initial procedure. After this has been achieved, the clinician should think of all possible treatment alternatives and filter the best alternatives for each individual patient among a list of realistic choices, always considering the patient as a whole. The dentist is expected to evaluate the pros and cons of each alternative, weighing the relative benefits of the various treatment options.

Fig 2-6 Extensive FPD replacing missing maxillary teeth. *(a)* Occlusal view of a maxillary study cast showing the number and distribution of remaining natural abutments. *(b)* Full-arch FPD. *(c)* Clinical view of anterior region with FPD in place. *(d)* Lateral view of the posterior left side with FPD in place. *(e)* Lateral view of the posterior right side with FPD in place.

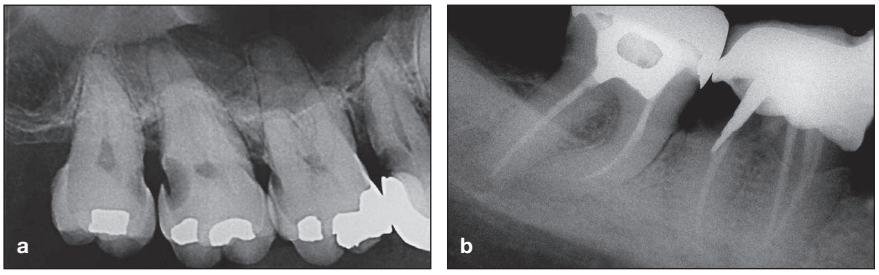


Fig 2-7 *(a)* Radiographic image of extensive carious lesions on the distal aspect of both the second molar and second premolar. *(b)* Radiographic image of an extensive carious lesion on the distal aspect of the mandibular second molar.

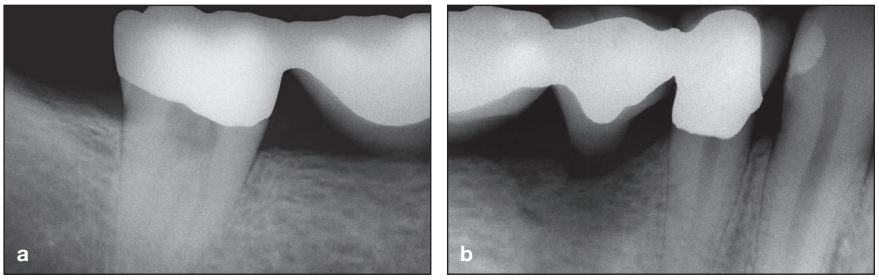


Fig 2-8 *(a and b)* Short-span FPDs with good marginal fit.

they are satisfactory or not. Old radiographic images can be helpful to assess the fit of restorations in the interproximal areas and the presence of recurrent decay.

Conventional fixed prosthodontics history. This category includes fixed partial dentures (FPDs) and full-mouth rehabilitations. Extensive FPDs with long spans are usually more difficult to maintain for long periods of time because if one of the abutments is affected by a given problem, the entire prosthetic work may be lost (Fig 2-6). With the advent of implant dentistry, the need for FPDs with several pontics has decreased because abutments may be strategically placed in the edentulous areas, allowing for the fabrication of individual crowns.

Poor marginal fit can lead to decay and is a common problem affecting natural abutments. Extensive carious lesions may develop in both vital and endodontically treated teeth and may compromise tooth longevity (Fig 2-7). Such a problem is commonly associated with poor marginal fit.[11] Short-span FPDs with good marginal fit can have a good long-term prognosis (Fig 2-8).

Conventional removable partial denture history. Patients wearing removable partial dentures (RPDs) should be questioned about esthetics, function, comfort, retention, frequency of adjustments and repair, and how long they have been in service. It is also important to find out how many prostheses have been fabricated before. Complaints usually involve esthetics related to extracoronal retainers (clasps) in the anterior region, especially in high smile line situations. It is not uncommon for patients to report tenderness and mo-

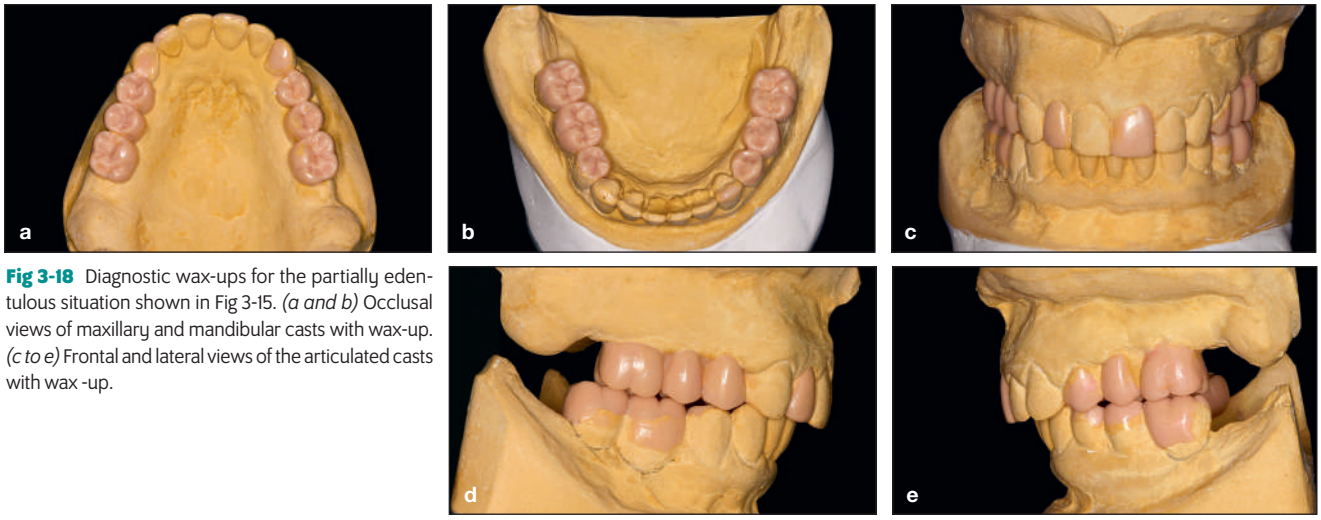


Fig 3-18 Diagnostic wax-ups for the partially edentulous situation shown in Fig 3-15. *(a and b)* Occlusal views of maxillary and mandibular casts with wax-up. *(c to e)* Frontal and lateral views of the articulated casts with wax -up.

Fig 3-19 *(a and b)* Frontal view of maxillary cast without and with wax-up. The wax-up was performed to simulate crown lengthening procedures in the anterior teeth (canine to canine). *(c and d)* Frontal smile and intraoral views of the initial clinical situation. *(e and f)* Frontal smile and intraoral views of the clinical situation after crown lengthening procedures with final prosthetic work.

Articulated casts

The precise mounting of diagnostic casts on a semiadjustable articulator enables the dentist to clearly envision the relation between the maxillary and mandibular arches without the interference of the cheeks, tongue, and saliva. Important information regarding the remaining natural dentition (eg, number, position, and distribution), the existing prosthetic work, and a detailed occlusal analysis is often made available to supplement clinical examination findings. The analysis of edentulous areas, including space assessment, can also be conducted in a very efficient manner when compared to intraoral assessments (Fig 3-17).

Diagnostic wax-up

The diagnostic wax-up is an essential source of planning information, and it allows the dentist to visualize the correction of problems by creating an image of a more ideal situation for re-establishing function, phonetics, and esthetics.[5,9] Preferably, diagnostic wax-up procedures should be carried out on articulated casts. Problem lists related to tooth examination, occlusal examination, and examination of edentulous areas can be extremely helpful at this stage because they can be used as a reference to accomplish the necessary improvements (Fig 3-18). Once completed, it can give a very precise view

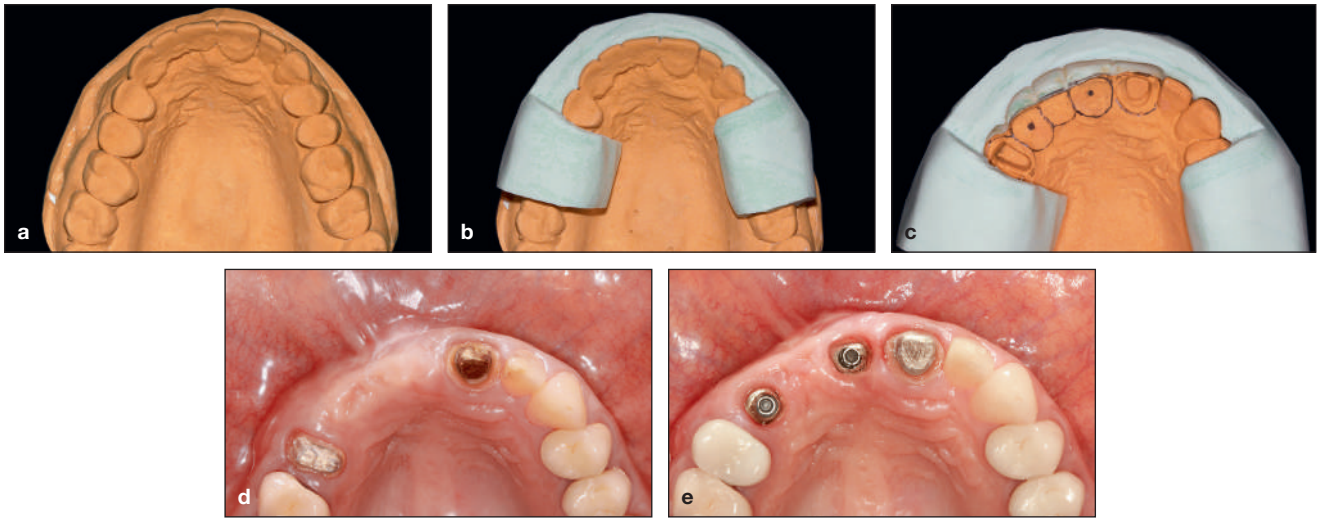


Fig 3-22 Diagnostic index for a partially edentulous situation. *(a)* A study cast of provisional restorations. *(b)* Occlusal view of maxillary cast with a silicone index. *(c)* Occlusal view of maxillary cast showing the anterior edentulous area plus the silicone index. The silicone index serves to record the buccal position of the future prosthetic crowns in relation to the edentulous ridge. This same index can be used for the assessment of horizontal prosthetic space and can be of great assistance in planning the position of implants. *(d and e)* Occlusal view of the anterior region of the maxillary arch before and after implant placement. Proper positioning of the implants was achieved because of the use of a silicone index and surgical template during presurgical planning.

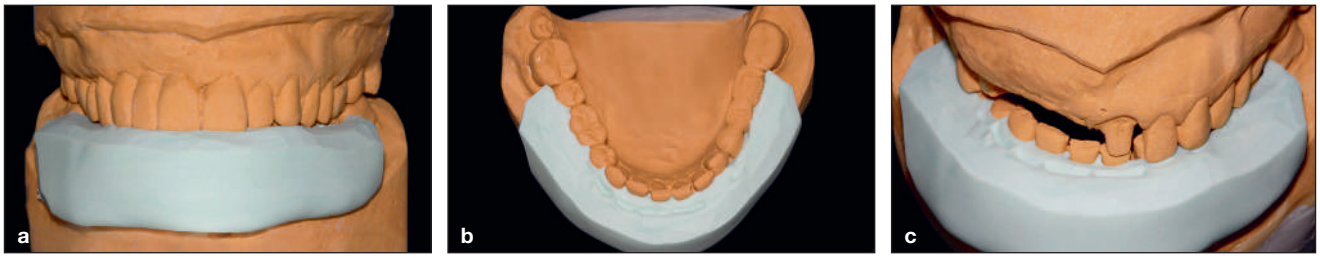


Fig 3-23 *(a to c)* Diagnostic index in the mandible.

Diagnostic index

A *diagnostic index* can be defined as a core or mold used to record or maintain the relative position of a tooth or teeth to one another, to a cast, or to some other structure.[1] A diagnostic index made on a wax-up (or duplicate cast of a wax-up) serves as a vital tool for the evaluation of edentulous areas in both partially and completely edentulous situations, particularly when planning implant cases.[5,10] Different materials can be used for the fabrication of diagnostic indexes, plaster and silicone being the most common.

Figure 3-22a shows a study cast of provisional restorations, and Fig 3-22b shows a silicone index fabricated over the study cast. With the use of a silicone index placed on the study cast without the provisional restorations (Fig 3-22c), the dentist as well as the laboratory technician can study the relation between the position of the artificial crown and the residual alveolar ridge and determine the amount of existing space for fabrication of the future prosthesis. The result of this analysis may be of great value when planning surgical procedures in implant dentistry because it may determine the need for either ridge reduction or grafting procedures (Figs 3-22d and 3-22e).

When fabricated on the mandibular cast, the silicone index can give an idea of the length of the future maxillary crowns, the position of the incisal edges of the future maxillary crowns, and the amount of vertical space for fabrication of the future restorations (Fig 3-23). Diagnostic indexes can also be fabricated on completely edentulous arches in a similar manner and for the same purposes (Figs 3-24 and 3-25).

Radiographic templates

A radiographic template (guide) is an extremely valuable tool in the assessment of the patient's clinical scenario, especially when planning implant cases. This appliance allows the clinician to obtain essential information about the condition

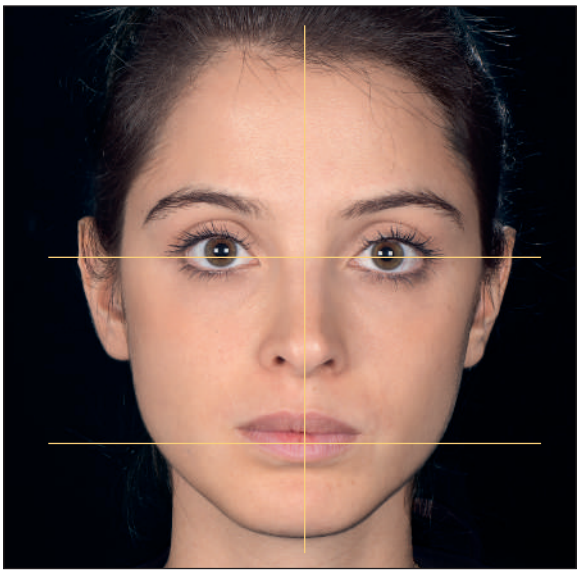


Fig 4-2 Vertical and horizontal facial reference lines serve as an orientation for the analysis of both frontal and lateral aspects of the face. The main vertical reference line is referred to as the *facial midline*. The interpupillary line and commissural line are the main horizontal lines.

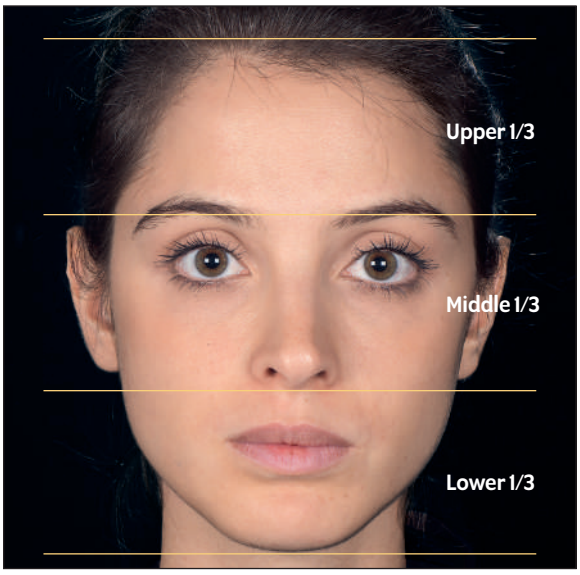


Fig 4-3 Frontal view of the face showing the facial thirds. (Photograph reprinted from Flávio A. Dermal Fillers for Facial Harmony. Chicago: Quintessence, 2019.)

anterior teeth (parallel to the occlusal plane). When a top or bottom viewing angle is created, the viewer's perception is compromised. This is a significant consideration when a patient assesses his or her own occlusal plane and smile in a mirror. The manner in which the mirror is positioned or held by patients in relationship to their face, either above or below the horizontal plane, influences their perception of their own smile.

Facial analysis may begin by observing the patient from a frontal view and using the horizontal lines as references. Artistic principles serve to assist the clinician in understanding facial esthetics. The face is divided into horizontal thirds (Fig 4-3). The upper third extends from the hairline to the ophriac line, the middle third from the ophriac line to the interalar line, and the lower third from the interalar line to the menton (the most inferior point of the chin). Facial thirds are not exactly equal in all types of patients and may vary according to ethnicity. Variations (in height) of the facial thirds may range from 55 to 65 mm.[12] The width-to-height ratio of the face is typically 3:4, with an oval-shaped face being the esthetic ideal.[13] While minor discrepancies in these measurements do not compromise esthetics, major discrepancies may be suggestive of medical problems or problems associated with growth and development.

The lower third of the face can be further divided into thirds: the upper third from subnasale to stomion, the middle third from stomion to the labiomental crease, and the lower third from the labiomental crease to menton (Fig 4-4a). These thirds define the upper lip, lower lip, and chin. Note that the thirds are not equal in height. In optimum facial esthetics, the distance from subnasale (base of the nose) to the upper lip should be approximately half the length of the lower lip to menton (Fig 4-4b). When treatment is performed on full-mouth reconstruction cases, an evaluation of the facial thirds—from the hairline to midbrow, midbrow to subnasale, and subnasale to soft tissue menton—is required in order to obtain a more ideal facial proportion. An imbalance of the facial thirds may result from open and closed bites as well as posterior bite collapse with loss of OVD (Fig 4-4c).

As previously mentioned, in a harmonious face the main vertical line (facial midline) must be perpendicular to the horizontal lines. Therefore, the facial midline must be perpendicular to the interpupillary line and should coincide with the maxillary central incisal line. According to Golub,[14] the relationship between the horizontal and vertical reference lines offers one of the most outstanding facial contrasts and is the anchor of the smile on the face.

From a lateral perspective, in addition to the horizontal lines, several measurements may be used to evaluate the patient's profile. The most common include the nasolabial angle (Fig 4-5) and the profile angle (Fig 4-6). The nasolabial angle can be used to assess lip position/support. This angle is constructed from two lines (one tangent to the base of the nose and one tangent to the upper vermilion border of the lip) that intersect at subnasale; the measurement of this angle generally ranges from 85 to 105 degrees, and 90 degrees is

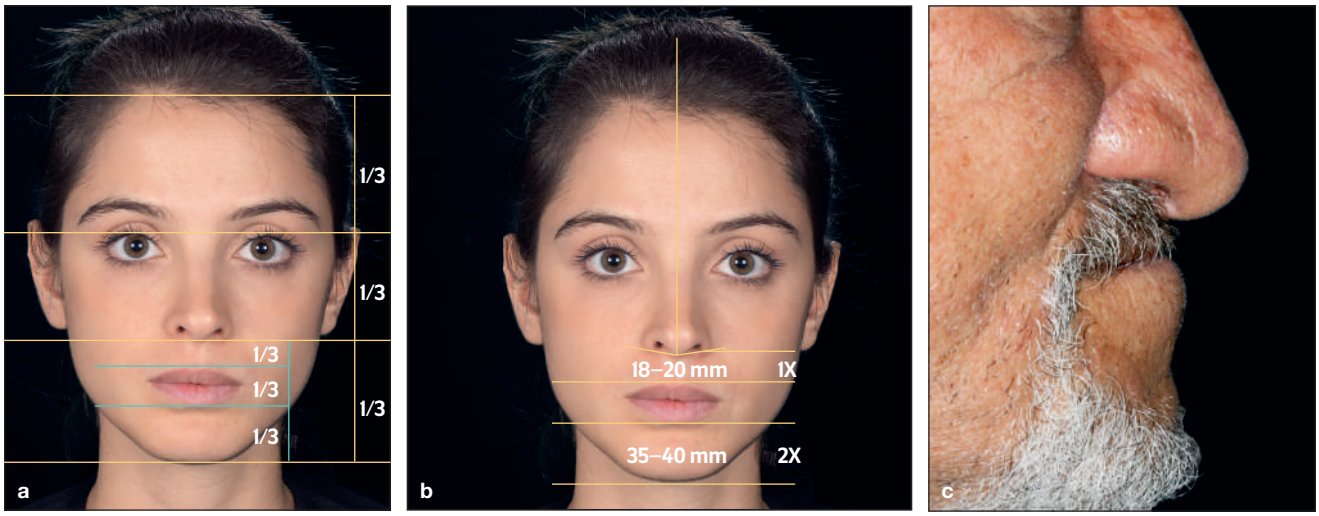


Fig 4-4 *(a)* Frontal view of the face showing the lower third further divided into thirds. *(b)* In optimum facial esthetics, the distance from subnasale (base of the nose) to the upper lip should be approximately half the length of the lower lip to menton. *(c)* The height of the lower facial third has been affected because of posterior bite collapse with loss of OVD. This condition results in an imbalance of the facial thirds.

Fig 4-5 *(a)* Lateral view of the face showing the patient's nasolabial angle (NLA). *(b and c)* Nasolabial angles outside normal range resulting from inadequate position of prosthetic teeth and lack of maxillary dentition, respectively.

considered normal[9] (see Fig 4-5a). Major alterations in these measurements can be indicative of problems affecting lip support (eg, inadequate position of prosthetic teeth; see Figs 4-5b and 4-5c). The patient's profile angle extends through the glabella, subnasale, and soft tissue pogonion and should be approximately 165 to 175 degrees. This type of profile is considered normal and represents a Class I occlusion. Depending on the variation of this angle, the patient's profile can also be classified as convex or concave (see Figs 4-6b to 4-6d). Both situations can be suggestive of an altered maxillomandibular relationship and may be associated with growth and development problems.

The information presented so far is intended to give the general practitioner and/or the restorative dentist an overall notion of facial analysis. The treatment of patients exhibiting significant esthetic compromise such as skeletal deformities requires additional examination aids (eg, cephalometric radiographs) associated with specific treatment procedures (orthognathic surgery). These procedures are more in the domain of other specialties such as orthodontics, oral surgery, and cosmetic surgery.

Fig 4-20 *(a and b)* Frontal views showing inadequate crown size and proportion of the maxillary anterior teeth. The width-to-length ratio of the central and lateral incisors is approximately 1:1, resulting in an unnatural-looking smile. *(c)* Diagnostic wax-up of the anterior teeth re-establishing the correct width-to-length ratio of the central and lateral incisors. The study cast with the diagnostic wax-up provides important information for planning the crown lengthening procedures. *(d)* Frontal view of prepared teeth after removal of the existing restorations and crown lengthening. *(e)* Final restorations ready for try-in. *(f and g)* Definitive e.max (Ivoclar Vivadent) restorations right after cementation.

Fig 4-21 *(a to c)* Frontal views of maxillary anterior teeth with altered crown size and proportion as a result of abrasion and attrition.

and older patients, on the other hand, may display short square or tapered incisors as a result of tooth wear. This results in a displeasing appearance because the width-to-length ratio of the central incisors exceeds 85%. This type of arrangement also results in a straight smile line, further compromising the harmony of the smile.

Crown position

Crown position may be investigated in regard to mediolateral position and vertical position. It must be emphasized that symmetry at the dental midline (central incisors) is mandatory.

The main goal in assessing crown position is to evaluate the location and axis of the dental midline in relation to the facial midline and determine whether there are mediolateral discrepancies in tooth position. In an esthetically pleasing smile, facial and dental midlines should be coincident.[22,24,26] Severe discrepancies between the maxillary central incisal midline and the facial midline may require orthodontic therapy to restore the coincidence of the midlines.

Misalignment of the maxillary central incisal midline and the mandibular central incisal midline is not a major esthetic problem but may be indicative of occlusal disharmony and should be investigated.

As the patient smiles, the incisal plane and the plane of occlusion can be used as reference to evaluate the position of anterior and posterior teeth. The incisal and occlusal surfaces of the teeth should coincide with Camper's plane. If the posterior plane of occlusion is correctly aligned, it may serve to diagnose faulty position (extrusion/intrusion) of

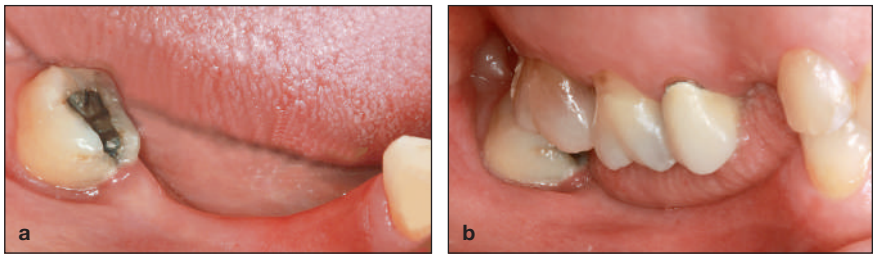


Fig 5-31 *(a)* Lateral view showing mesial drifting of the second molar. *(b)* Lateral view showing the occlusal scheme in the posterior region. Note that because of the missing teeth adjacent to the second molar, drifting will continue to occur.

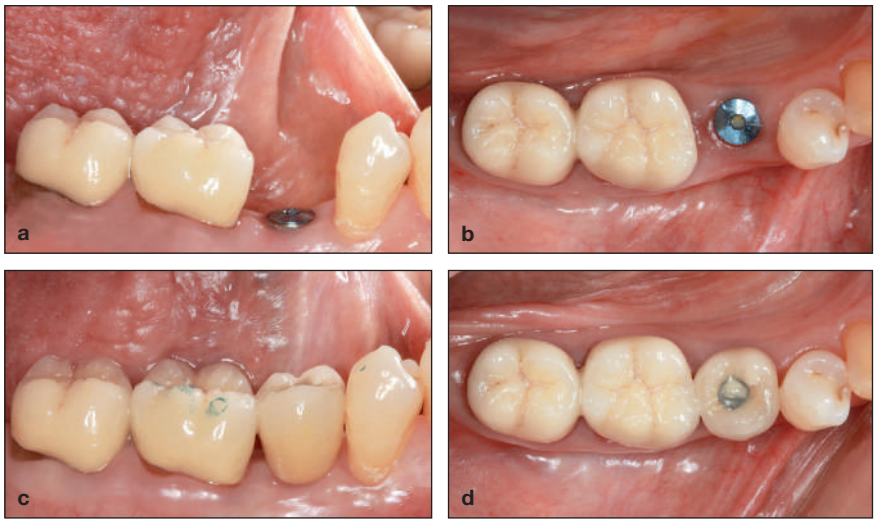


Fig 5-32 *(a and b)* Lateral and occlusal views of a rotated mandibular first premolar. *(c and d)* Final restoration in place. The rotated premolar required consideration when designing the interproximal contacts.

Clinical Condition of the Periodontium

There are three basic clinical conditions of the periodontium: *(1)* health, *(2)* gingival disease, and *(3)* periodontal disease. These conditions may be seen separately or in combination in the same individual. This section describes the most common characteristics of each of the three conditions.

Fig 5-33 Clinical view of healthy gingiva around natural teeth. Note that no signs of inflammation are present and the gingival margin has a regular and scalloped outline, slightly coronal to the CEJ.

The healthy periodontium

The healthy attached gingiva is pale pink in color and is frequently stippled. No edema or redness is seen as a result of inflammation, and the gingival margin has a regular and scalloped outline, slightly coronal to the CEJ. The mucogingival line is clearly visible because of the difference in color between the noninflamed pale pink attached gingiva and the deeply red alveolar mucosa[61,62] (Figs 5-33 and 5-34).

The clinical characteristics of healthy soft tissues are as follows:

- Gingival tissues are pink and stippled. They may appear darker in patients with darker skin coloration.
- No signs of inflammation are observed (eg, bleeding upon probing).
- Coronal margins of the soft tissues are located at or slightly coronal to the CEJ.
- Probing depths range from 1 to 3 mm.

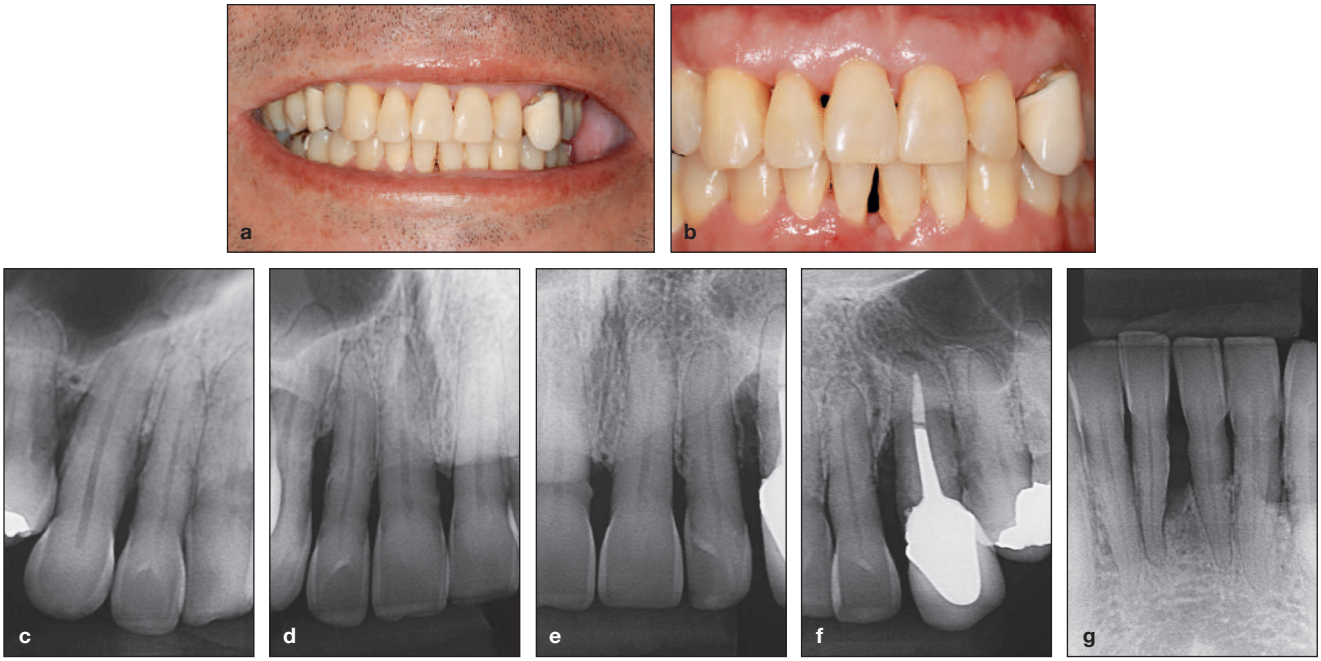


Fig 5-41 *(a and b)* Clinical photographs showing drifting of the maxillary left canine as a result of severe periodontal disease with advanced bone loss. *(c to g)* Periapical radiographs of the anterior teeth of the maxillary and mandibular arches. Radiographic images indicate advanced bone resorption on the maxillary right and left canines and on the mandibular central incisors.

Clinical example

Figure 5-41 illustrates a clinical example of the procedure for conducting periodontal examination and charting. The patient in this case presented for examination complaining about pain at the maxillary left canine during function. The patient also reported that the tooth was mobile and had been moving. He was also unhappy with the esthetics of his teeth (Figs 5-41a and 5-41b). Periapical radiographs of the anterior teeth of both arches can be seen in Figs 5-41c to 5-41g. Radiographic examination of the maxillary left canine suggested a vertical defect on the mesial aspect and a bone loss of approximately 80% (see Fig 5-41f). Clinical examination of the tooth in question revealed class III mobility and probing depths of 7 mm on the mesial and distal aspects (facially). Figures 5-41h and 5-41i show the periodontal examination forms for both the maxillary and mandibular anterior teeth. After recording data concerning the chief complaint, an overall periodontal examination was conducted, and advanced periodontal disease was also detected on the maxillary canine and the mandibular central incisors. Clinical and radiographic data concerning the maxillary right canine and the mandibular central incisors confirmed a very poor prognosis for these elements. Generalized gingivitis and calculus was found in the remaining areas but without major attachment loss.

Once a consensus concerning the prognosis of both the maxillary canines and the mandibular central incisors was reached, provisional restorations were prepared to replace the hopeless teeth. Figure 5-41j shows the provisional removable restoration fabricated prior to extraction of the canines. Initially, only the coronal parts of these teeth were removed, and the roots were kept in the alveolar ridge. The provisional restoration was then tried in and adjusted, and the patient was referred to the periodontist for extraction of the roots. Once extractions were performed, the provisional restoration was relined and adjusted. Figure 5-41k shows the provisional removable partial restoration in the patient's mouth after surgical procedures were performed.

In this particular case, implants were placed at a subsequent appointment (Figs 5-41l and 5-41m). In the mandibular arch, because of horizontal space only one implant was placed (see Fig 5-41m). Figures 5-41n and 5-41o show frontal views of the finalized implant-supported crowns in both arches. In the mandibular arch, the crown replacing the right central incisor was designed as a cantilever.

Fig 7-12 *(a and b)* Clinical views of a situation in which implants were placed in a less-than-ideal scenario. *(c to e)* A detachable acrylic resin gingival mask was fabricated to improve esthetics.

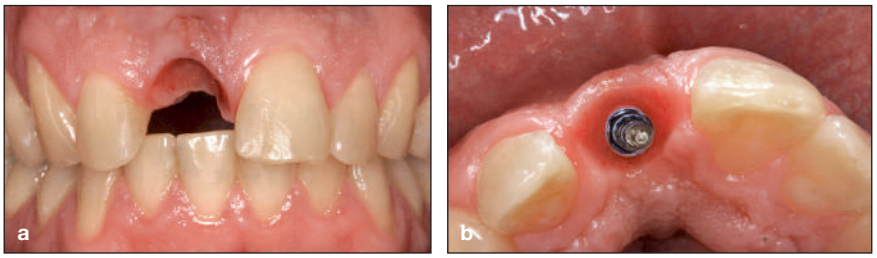


Fig 7-13 *(a and b)* Frontal and occlusal views of a patient with a thick gingival biotype.

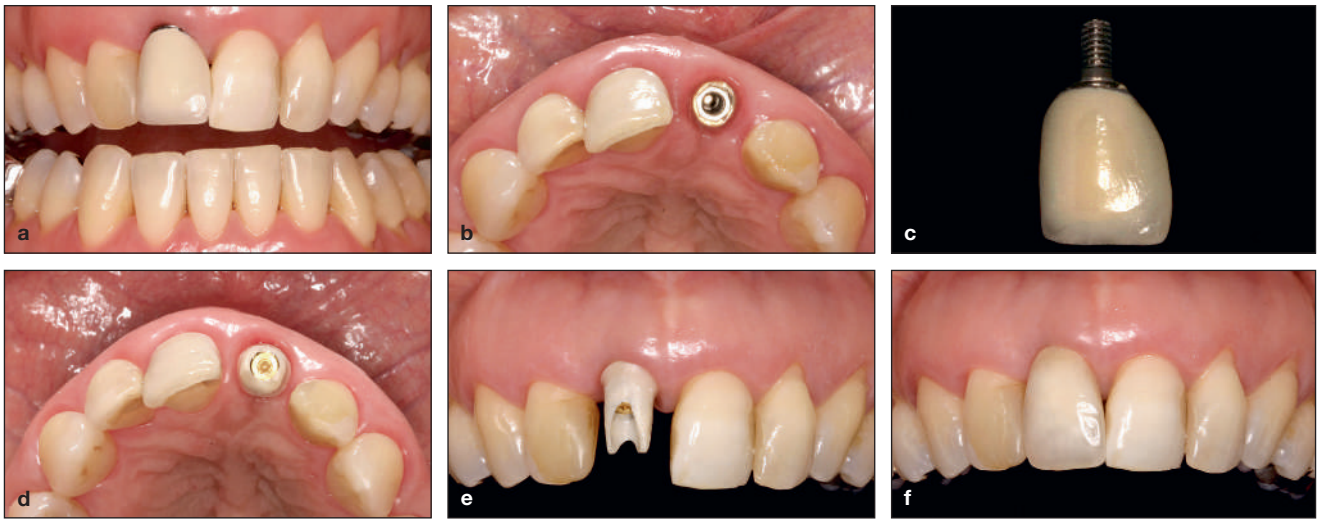


Fig 7-14 *(a and b)* Frontal and occlusal views of a patient with a thin gingival biotype. Note that the titanium component of the restoration *(c)* is visible, compromising esthetics. *(d to f)* Replacement with a metal-free restoration leads to much more esthetic results.

Elements related to hard tissue structures

The study of hard tissue elements includes analysis of the size, shape, and inclination of the edentulous ridge. These elements can be affected by several factors, the most important being the history of the lost tooth or teeth and the restorative modality used to replace them.

After teeth are extracted, bone volume is lost from the alveolar ridge. As a result, soft tissue structures can also be affected. The amount of change that occurs may be influenced

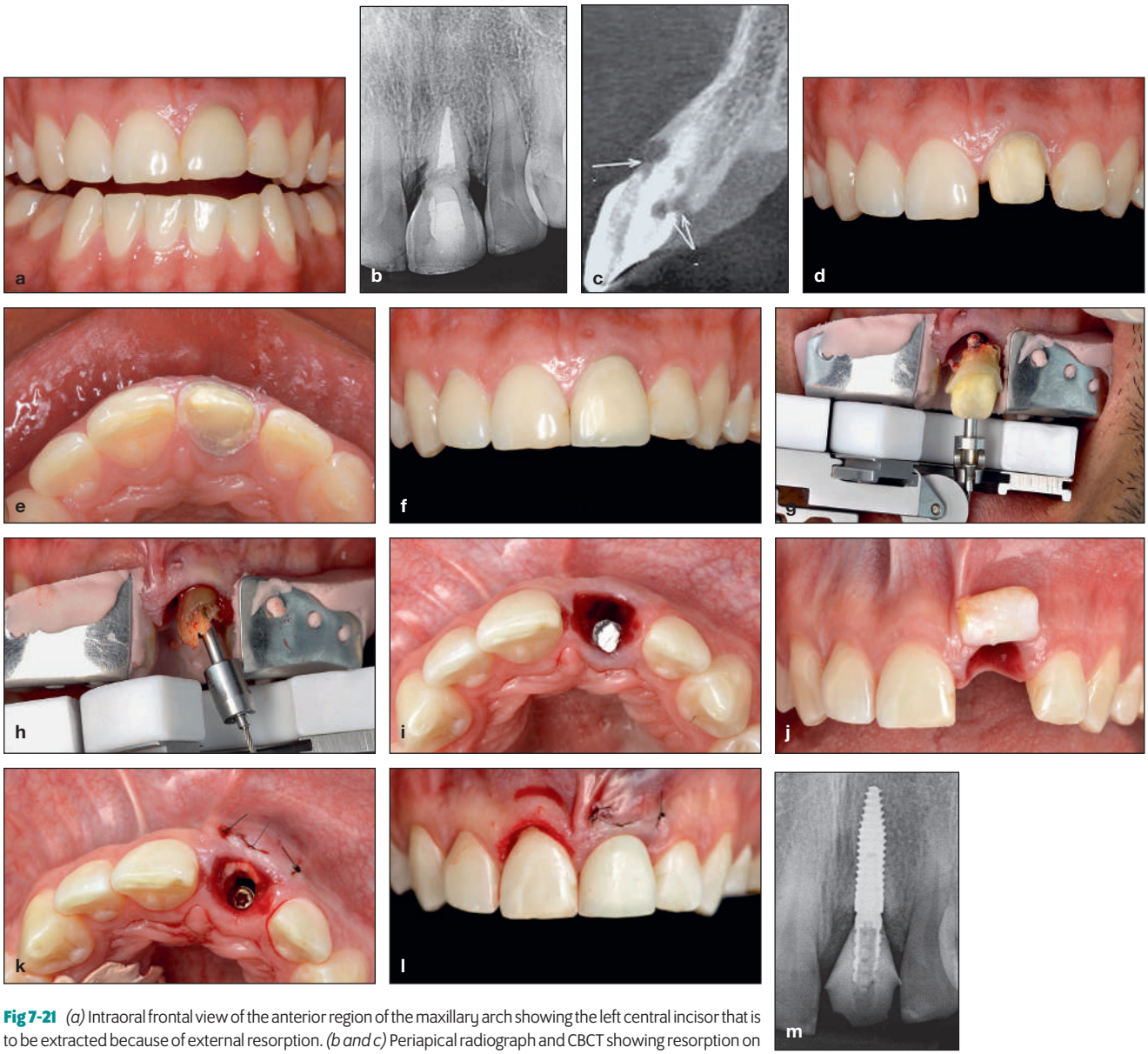


Fig 7-21 *(a)* Intraoral frontal view of the anterior region of the maxillary arch showing the left central incisor that is to be extracted because of external resorption. *(b and c)* Periapical radiograph and CBCT showing resorption on the cervical aspect of the root (mesial and distal). *(d and e)* Frontal and occlusal views showing crown preparation for a full-coverage provisional restoration. The provisional restoration will be modified and used after tooth extraction as an implant-supported provisional restoration. *(f)* Left central incisor with the provisional restoration in position. *(g and h)* Atraumatic extraction of the tooth. Because of the resorption process, the coronal and radicular parts of the tooth were removed separately. *(i)* Occlusal view of the extraction site after implant placement. Note that the implant has been positioned more palatally. The gap between the buccal plate and the implant surface will be filled with bone substitute material for volume preservation and a soft tissue graft. *(j)* Soft tissue grafting was performed to optimize the position of the gingival contour and papilla level. *(k)* Bone substitute material was then used to maintain bone volume. *(l)* Frontal view of the provisional crown in place after the completion of surgical procedures. Note that the soft tissue contour of the right central incisor was modified to increase the length of the crown. *(m)* Periapical radiograph of the installed implant. (Surgical photographs courtesy of Dr Jose Alfredo Mendonça.)

alveolar ridge. Atraumatic tooth extraction followed by flapless implant placement may be considered for this type of situation. More predictable results were observed when the labial plate was intact and the implant more palatally positioned. It is important that the buccal plate be at least 1 mm thick to prevent or minimize bone loss and gingival recession.[24] Figure 7-21 illustrates a situation in which a maxillary left central incisor was to be extracted because of external resorption. All the necessary precautions were taken to minimize soft tissue recession and bone resorption.

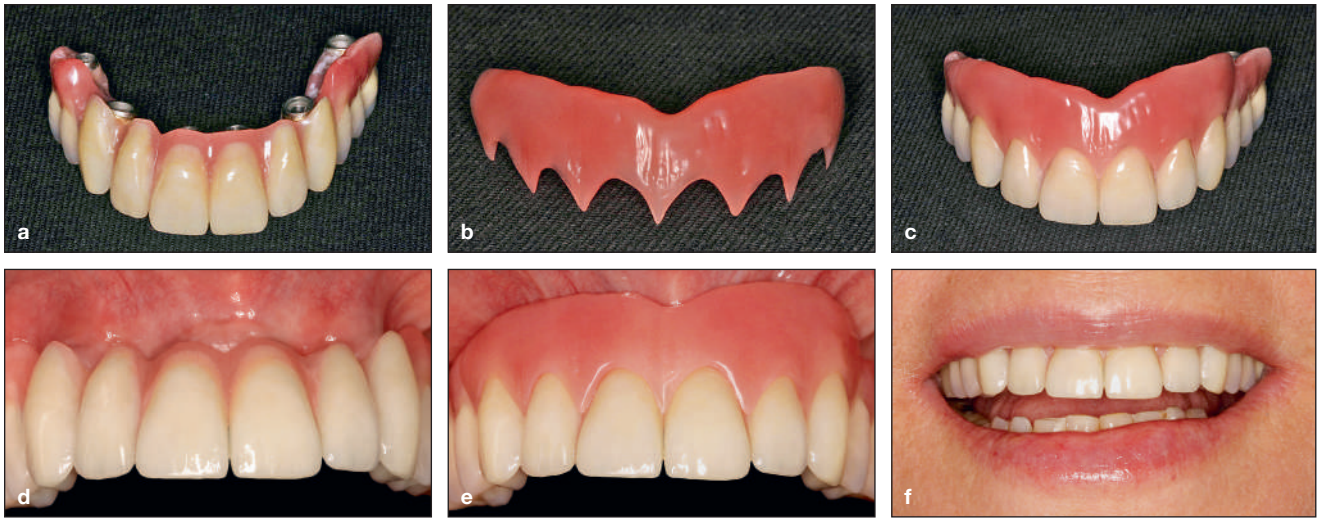


Fig 7-89 *(a)* Frontal view of a full-arch fixed metal-acrylic maxillary prosthesis without the anterior buccal flange. *(b)* Detachable flange. *(c)* Frontal view of the prosthesis with the anterior buccal flange in place. *(d)* Intraoral view of the prosthesis in the patient's mouth without the anterior buccal flange. *(e)* Intraoral view of the prosthesis in the patient's mouth with the anterior buccal flange. *(f)* Frontal view of the patient's smile with the fixed prosthesis plus the buccal flange in place.

modified into a favorable scenario (class III, modification 1 or 2) by means of surgical procedures (see Fig 7-41), and an informative radiographic stent can be of great help in generating essential information for this procedure to be successfully accomplished. In analyzing the information derived from CT image interpretation, the dentist may determine the precise location of the prosthesis-tissue junction, the soft tissue thickness, as well as the bone volume and architecture. With this knowledge the dentist is able to precisely envision the entire ridge reduction process. Figure 7-87 shows part of the presurgical planning process. This diagram shows the patient's existing situation (see Fig 7-87a) and what is intended to be achieved after surgical procedures have been performed (see Fig 7-87b).

Using the crest of the ridge as the starting point, the dentist is able to measure how much bone should be removed in order for a favorable relation between the ridge and the prosthesis to be created (*yellow lines* in Fig 7-87a). To achieve this, reduction should be performed so that the height of the ridge (bone level plus soft tissue thickness) and the prosthesis-tissue junction are at the same level (in the sagittal perspective). Once this has been established, it is possible to measure how much osseous structure is left (after ridge reduction) and determine whether there is still enough bone volume for implant placement. If, after the planned ridge reduction, there is still sufficient bone for implant placement (see Fig 7-87b), then the prognosis for the fabrication of a fixed restoration is good. The *red lines* in Figure 7-87b indicate soft tissue thickness. Again, it is important that the height of the ridge and the buccal flange of the prosthesis be at the same level (in the sagittal perspective). This will allow for proper prosthesis design (Fig 7-88).

In some cases, the amount of bone reduction required for establishing a favorable prosthesis-ridge relation may negate the possibility of implant placement. In such a situation, unless a detachable buccal flange is fabricated (Fig 7-89), a removable prosthesis may work better than a fixed restoration.

With the knowledge of the principles and the diagnostic tools mentioned above on hand, the clinician may begin the examination process.

The Examination Process

As previously pointed out, the examination of completely edentulous arches follows the same sequence described for the examination of edentulous areas in partially edentulous situations. Therefore, the basic elements to evaluate during the examination of edentulous arches include the architecture of edentulous areas, the prosthetic crown–ridge relation, and the prosthetic space.

Architecture of the alveolar ridge

For those patients who have been wearing complete dentures for long periods of time, aspects related to the architecture of soft tissues, such as the interproximal papilla level and the facial marginal gingival tissue position around (future) prosthetic crowns, are not relevant because most of these patients have undergone significant ridge resorption and the prosthesis provided for this type of situation (be it fixed or

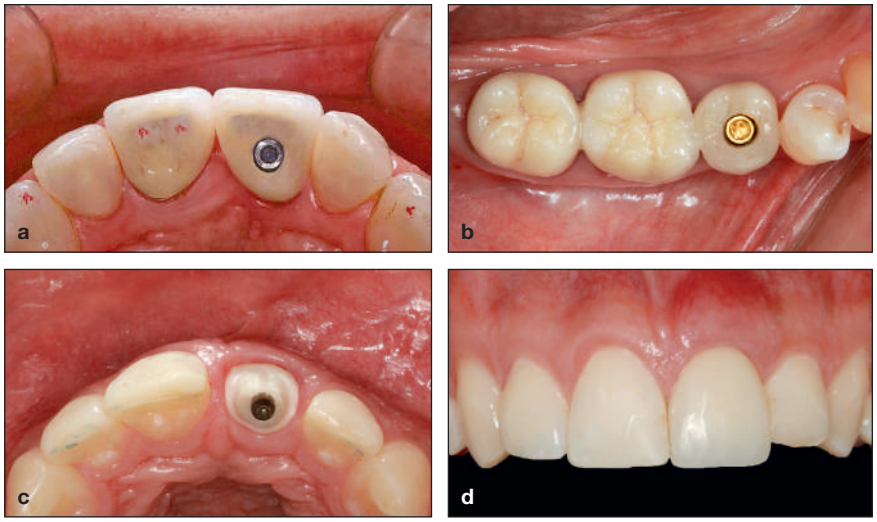


Fig 9-25 *(a and b)* Occlusal views of anterior and posterior crowns with the access hole to the prosthetic screw positioned between the incisal edge and the cingulum and on the central fossa of the occlusal table, respectively. Such positioning favors the fabrication of both screw-retained and cemented restorations. *(c and d)* Occlusal and frontal views of the anterior maxilla showing an implant replacing the left central incisor. In this particular case, an abutment was fabricated for a cemented restoration.

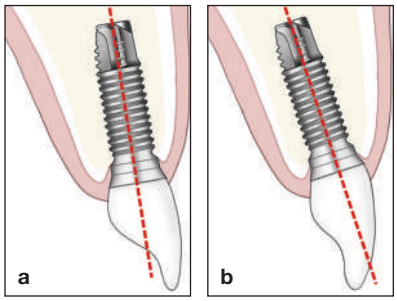


Fig 9-26 Diagram illustrating different labial inclinations. When the access hole to the prosthetic screw is located on the cingulum area *(a)*, the restoration may be screw-retained. If the access hole emerges on the incisal edge or on the buccal aspect of the crown *(b)*, either an angulated abutment may be used for a screw-retained restoration or a cemented restoration can be fabricated.

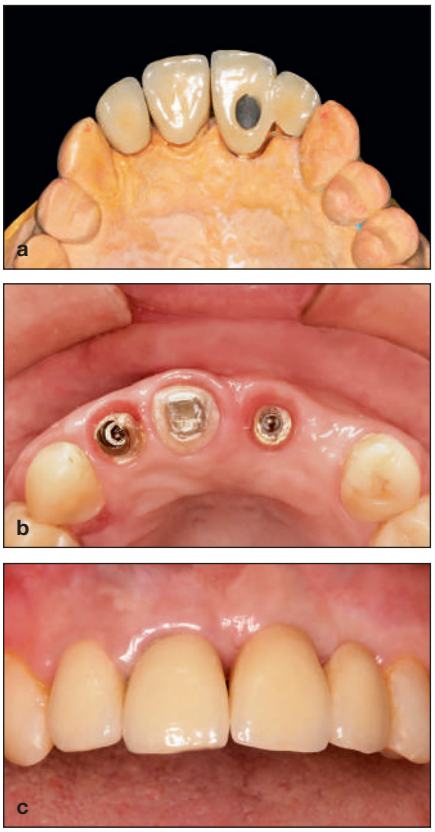


Fig 9-27 *(a)* Occlusal view of the maxillary study cast showing cemented (right lateral incisor) and screw-retained (left central incisor with cantilevered lateral incisor) implant-supported restorations. *(b)* Intraoral occlusal view. *(c)* Finalized restorations in the patient's mouth.

cemented restoration can be fabricated. Figure 9-27 illustrates both types of restoration in the same arch. When the implant emerges superior to the adjacent free gingival margin, the final prosthetic outcome will most likely be a longer prosthetic crown with poor esthetics. In general, this situation requires the use of an angulated abutment for the fabrication of the final prosthesis (Fig 9-28).

Therefore, it is important to emphasize that labial inclination may affect the mode of retention of a given restoration (screw- vs cement-retained). It is also important to consider that cemented restorations require more prosthetic space than screw-retained restorations. With this in mind, when replacing anterior teeth, particularly in situations involving deep bite and tight horizontal overbite, surgical procedures should be performed with a labial inclination that favors the fabrication of screw-retained restorations (see Fig 12-3). This will certainly facilitate restorative procedures.

Labiolingual position. If the implant is positioned too palatally, a prosthetic crown with a labial overcontour results. Occasionally, the loss of the labial alveolar bone results in a concavity, and unless ridge augmentation is performed, a cantilevered tooth results (Fig 9-29). Depending on the extent of the concavity, the future prosthetic crown will be not only cantilevered but also elongated (see Fig 9-29c). With ridge augmentation techniques and materials, it is now possible to correct osseous defects and place implants in an ideal position (Fig 9-30).

In the posterior region, if the implant is positioned palatally, the restoration is cantilevered facially. A lever arm may

Fig 9-36 *(a)* Lateral view of the posterior mandibular region showing implants replacing the first and second premolars and the first molar. Implants were inserted at the sites corresponding to the first premolar and first molar. However, the mesiodistal positioning of the implant replacing the first molar is not correct. There is insufficient space between the two implants (mesiodistal space) to provide for proper shape and size of the pontic *(b and c)*.

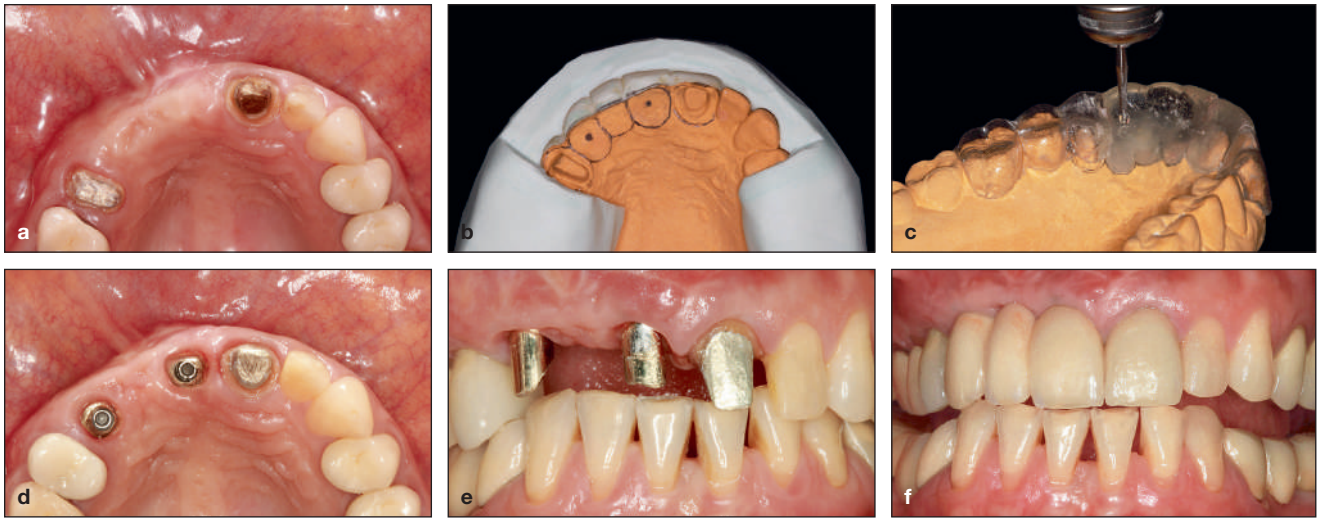


Fig 9-37 *(a)* Occlusal view of the anterior maxillary edentulous region with missing left central and lateral incisors and canine. *(b)* Occlusal view of the maxillary study cast with a silicone index in place. Note that space assessment and possible sites for implant placement have been defined. *(c)* Occlusal view of the maxillary study cast with the surgical template in position and being prepared. *(d and e)* Occlusal and frontal views of the inserted implants. *(f and g)* Intraoral and extraoral views of the finalized case. Despite minor limitations related to crown height, proper space assessment and implant positioning were accomplished.

Fig 9-38 *(a and b)* Periapical radiographs showing the left lateral incisor after crown fracture *(a)* and after tooth extraction and implant placement *(b)*. Note the difference in position between the root of the lateral incisor and the implant to replace it. The head of the implant is too much to the distal. *(c and d)* Clinical examination using the provisional restoration as a reference confirmed the radiographic findings.

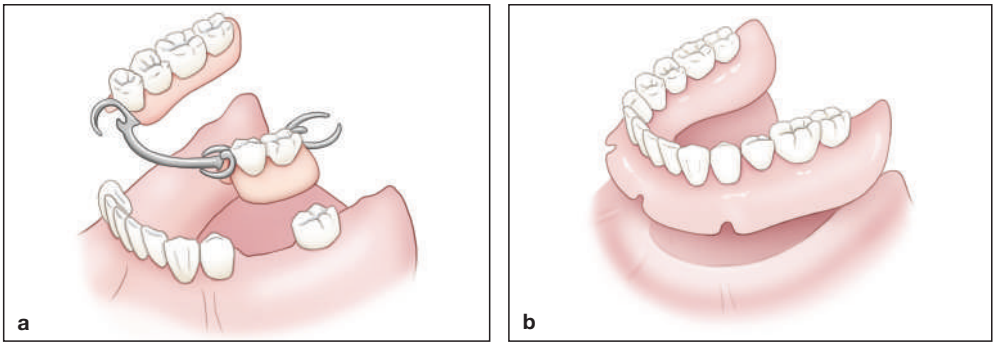


Fig 10-5 Diagrams illustrating removable restorative options for replacing missing teeth: *(a)* RPD. *(b)* Complete denture.

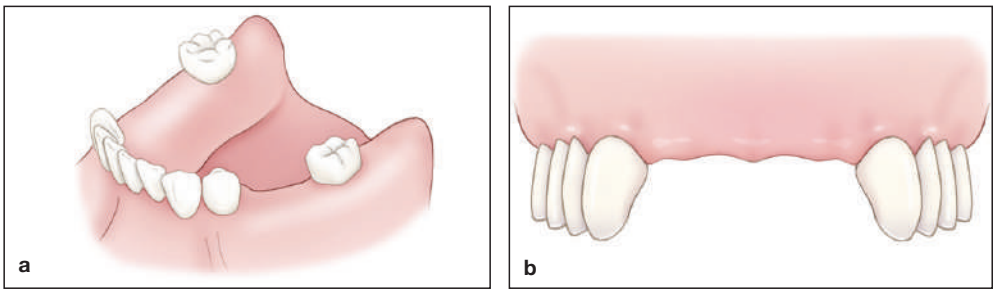


Fig 10-6 *(a and b)* Diagrams showing Kennedy Class III and IV situations.

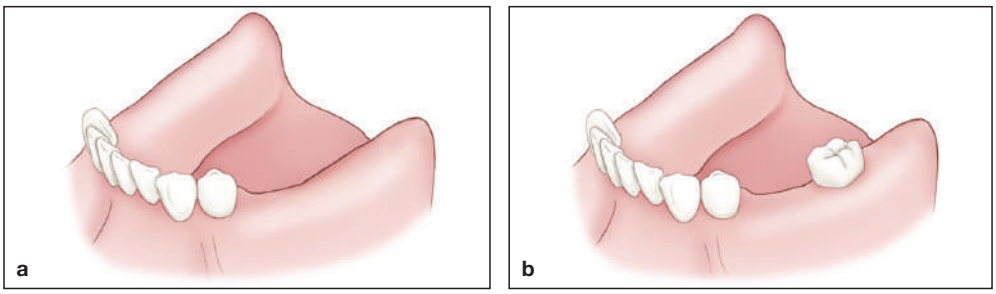


Fig 10-7 Diagrams showing Kennedy Class I and II situations.

natural teeth and the edentulous ridge (joint tooth/mucosa–supported prosthesis, Kennedy Class I and II; Fig 10-7). See chapter 6 for more information on the Kennedy classification.

Complete dentures can also be subdivided into two groups. The first group uses the alveolar ridge as the only source of support, while the second group uses the alveolar ridge and remaining roots for support and retention. Presently, edentulous ridge–supported removable prostheses are no longer the first choice of treatment, especially for young patients, because of the damage caused to the underlying tissues.[8,9]

Implant prosthetics

Implant prosthetics can be divided into three different groups that may be categorized according to: *(1)* type of support, *(2)* design, and *(3)* mode of retention (Fig 10-8). In the first category, restorations are classified according to the way support is obtained, and this aspect is directly related to the number and distribution of implants in the arch. Support may derive from implants only, from a combination of implants and natural teeth, or from a combination of implants and the edentulous ridge.

In implant-supported restorations, masticatory forces are solely withstood by implants, and this is only possible when implants are distributed throughout both anterior and posterior regions of the arch or in the presence of cantilevers (Fig 10-9). Implants can also be connected to natural abutments (implant/tooth–supported restorations). Caution should be used when selecting this option because the natural abutment can be subjected to occlusal overload and other problems.[10] In the particular situation where implants and an edentulous ridge are jointly used as support, implants are placed only in the anterior segment of the arch, and masticatory forces applied to the posterior region are directly transmitted from the acrylic saddle to the alveolar ridge (Fig 10-10). With this

Fig 12-29 *(a)* Occlusal view of the maxillary arch showing splinted implants. Note the combination of two types of attachments in the metal bar. There are four stud attachments and three "H" attachments milled in the bar. *(b)* View of the intaglio of the removable restoration showing the metal framework and the male parts of the attachments.

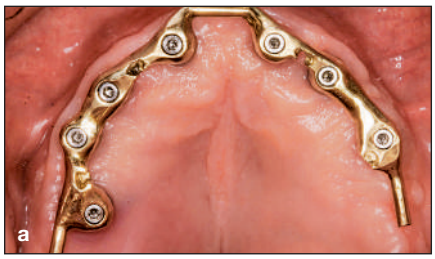
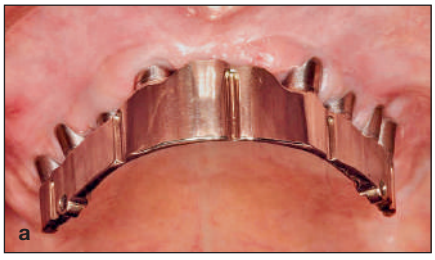


Fig 12-30 *(a to c)* Occlusal and lateral views of a metal bar with a combination of different types of attachments (clip attachments and an "H" attachment milled in the bar). *(d)* View of the intaglio of the removable prosthesis. Metal clips are stronger and last longer than plastic clips.



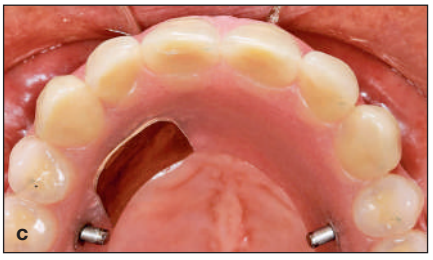


Fig 12-31 *(a and b)* Frontal and lateral views of the metal bar in the patient's mouth. Note the ring on the back of the bar. *(c)* Occlusal view of the prosthesis in the patient's mouth before the locking mechanism is activated. Note that the two pins are offset out of the prosthesis. For the retention mechanism to be activated, these two pins must be pressed with the fingers, causing them to slide and fit into the rings. *(d)* Views of the interior of the prosthesis and intaglio showing the key used to unlock the attachment on the left side. Note that on one side the pin is in the locking position, while on the other side it is unlocked. *(e)* The key inserted into the hole and the two pins in the unlocked position. *(f)* Lateral view of the prosthesis showing the access hole for the metal pin. To unlock the attachments, the key must be inserted and pressed. This will cause the pin to slide out of the ring, thereby disabling the retention system. With both sides unlocked, the prosthesis can be removed from the mouth. *(g)* Frontal view of the prosthesis.

SUPPLEMENTARY INFORMATION / ADDITIONAL PROCEDURES

Event #1:
After removing the existing prosthetic work, it was noted that the design of the post and core on tooth no. 9 was not satisfactory **(inadequate core design / insufficient interincisal clearance)**. Therefore, a new post and core should be fabricated to replace it.

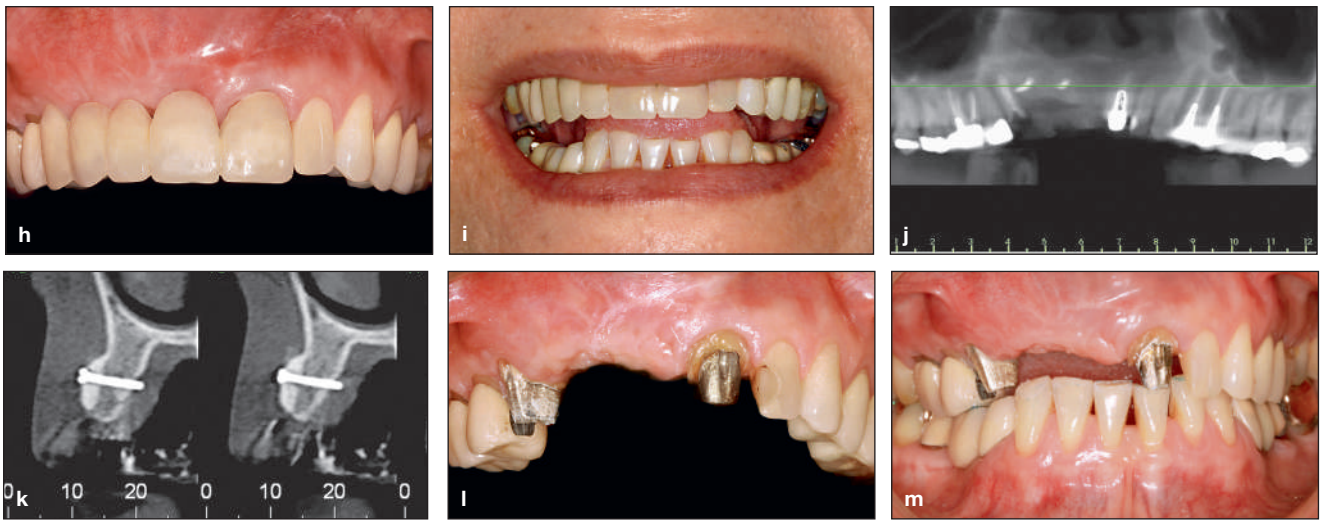
I (patient's name) authorize Dr Dentist to perform the additional procedure described above.

_____

Patient's signature

Date: _____

Fig 14-1g *(cont)* Consent document.



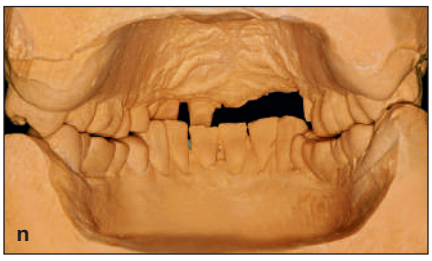


Fig 14-1 *(cont) (h and i)* Intraoral and smile views of the provisional restoration inserted and adjusted in the patient's mouth. *(j and k)* Radiographic images showing miniscrews used for the fixation of bone graft material. *(l)* Frontal view showing the architecture of the edentulous area after removal of the existing prosthetic work and extraction of the right central incisor. *(m)* Frontal view showing the maxillary and mandibular teeth in contact. *(n)* Lingual view of articulated casts. Note the vertical prosthetic space between the incisal of the anterior mandibular teeth and the opposing edentulous area. *(o)* Lateral view showing the clearance between the lingual aspect of the left central incisor post and core and the incisal of the opposing tooth. Because of insufficient space, a new metal post and core was fabricated. Also note the reduced vertical space as a result of the deep bite and the extrusion of the mandibular left canine and lateral incisor (distal aspect of the incisor and tip of the canine).