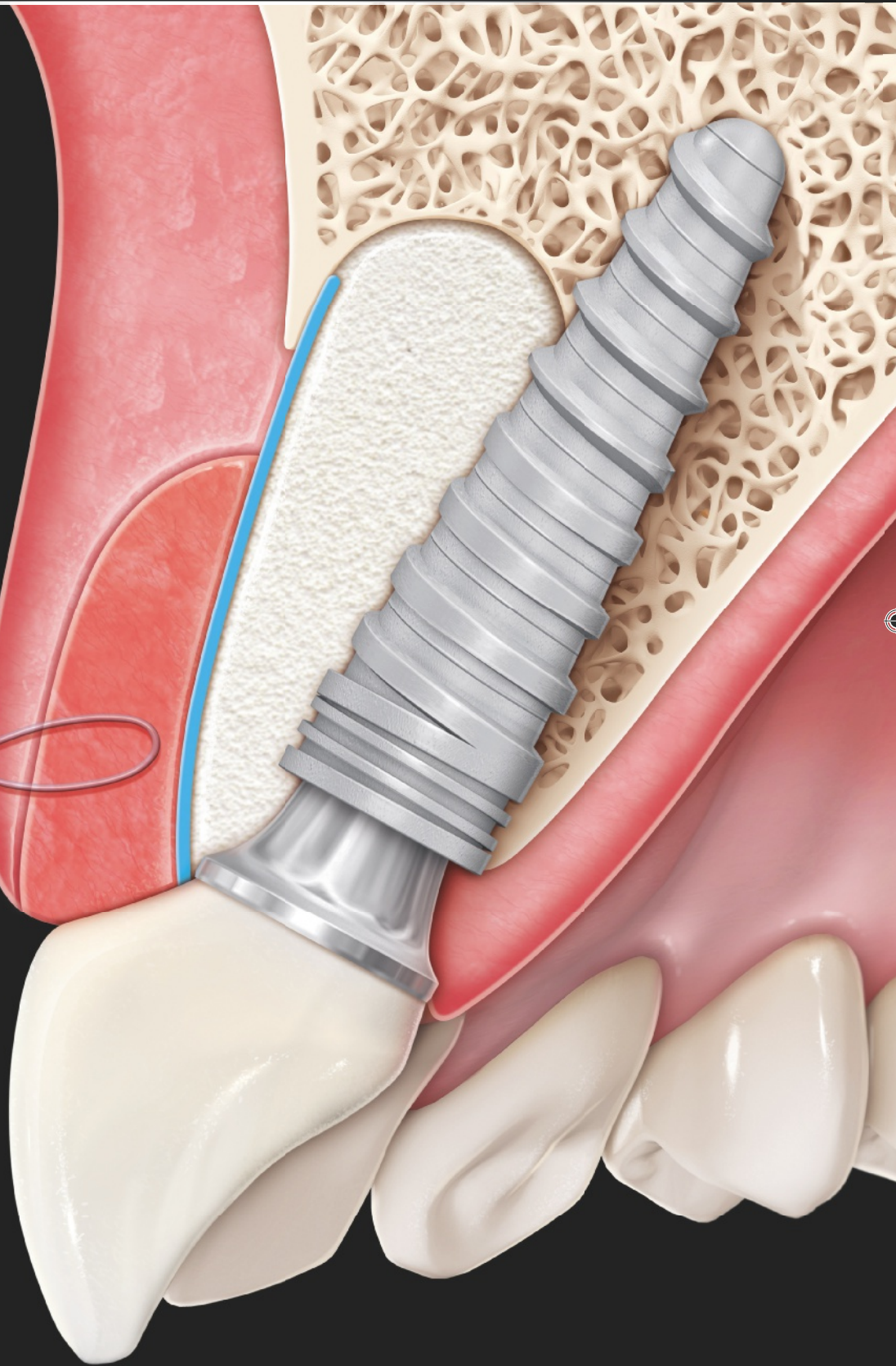


INTEGRATED ESTHETICS IN PERIODONTICS AND IMPLANTOLOGY

copyright ©
not for publication
Quintessenz

Fausto Frizzera
Jamil Awad Shibli
Elcio Marcantonio Jr



INTEGRATED ESTHETICS

IN PERIODONTICS AND IMPLANTOLOGY



Fausto Frizzera | Jamil Awad Shibli | Elcio Marcantonio Jr



INTEGRATED ESTHETICS

IN PERIODONTICS AND IMPLANTOLOGY

 QUINTESSENCE PUBLISHING

Berlin | Chicago | Tokio
Barcelona | London | Mailand | Mexiko Stadt | Paris | Prag | Seoul | Warschau
Istanbul | Peking | Sao Paulo | Zagreb



One book, one tree: In support of reforestation worldwide and to address the climate crisis, for every book sold Quintessence Publishing will plant a tree (<https://onetreepanted.org/>).



Title of original issue:
Estética Integrada
em Periodontia e Implantodontia
Copyright © 2018 Editora Napoleão Ltda., 2018

 QUINTESSENCE PUBLISHING
DEUTSCHLAND

Quintessenz Verlags-GmbH
Ifenpfad 2-4
12107 Berlin
Germany
www.quintessence-publishing.com

Quintessence Publishing Co Ltd
Grafton Road, New Malden
Surrey KT3 3AB
United Kingdom
www.quintessence-publishing.com

A CIP record for this book is available from the British Library.
ISBN: 978-1-78698-098-4

Copyright © 2022
Quintessenz Verlags-GmbH

All rights reserved. This book or any part thereof may not be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, or otherwise, without prior written permission of the publisher.

Translation: Luisa Cassiano
Editing: Quintessence Publishing Co Ltd, New Malden
Surrey KT3 3AB, United Kingdom
Layout and Production: Quintessenz Verlags-GmbH, Berlin,
Germany

Printed and bound in Croatia

PREFACE

Here at the first pages of this book, I have the feeling that we are about to start a beautiful journey about the current knowledge in periodontics and implant dentistry. I am convinced that many of us readers will know how to do justice to the authors' effort, by welcoming this book the way it deserves.

In its 11 chapters, we can see the authors' concern with presenting, substantiating, and explaining to readers in detail critical aspects of the development of new concepts and techniques that are reflected in clinical work.

This book, for its clarity, objectivity, logic, and current scientific concepts applied to the clinic, engages the reader. It is a democratic work that allows room for broad learning about the subjects covered. It presents strong clinical concepts and is based on the belief of the irreplaceable role of education for the development of the different specialties. This book is exceptional. The work is presented in an organized way, and in a general context, it is vast. The arrangement of the chapters is logical and well-documented, with the opening chapters serving as a solid foundation in the creation of knowledge.

With several decades of combined high-level education and clinical practice, the authors have experienced several paradigm shifts involving periodontics and implantology as clinic-oriented science. Additionally, they have accumulated many lessons from the learning process and translated them into applied knowledge. Therefore, not only the correct indications of different treatment options but also their limitations and controversies are presented in this book.

The absolute respect and interest in others, to patients, is evident between the lines of the book. The book explores several previously untouched clinical questions, showing the use of biologic knowledge and current scientific concepts as the basis of a demanding and questioning clinic. It is an open-hearted critique of the status quo of our specialties. It questions, examines, and does not accept second best. Thus, with tremendous intensity, it directs us toward the development of reliable, consistent clinical work and predictable and longitudinal results. It is passionate! It is a great pride to have been invited to preface it.

Mario Groisman



DEDICATION



This work is dedicated to the parents of today,
yesterday, or tomorrow who do,
did, or will do anything to make the world a better place for their children.

In memoriam of Elcio Marcantonio and Awad Abdalla Awad Shibli



ACKNOWLEDGEMENTS

To our dear brothers and brothers-in-law

To the Frizzera, Valiate, Shibli, and Marcantonio families

To our wives and daughters

To our friends, colleagues, and patients.

To the contributors of this book

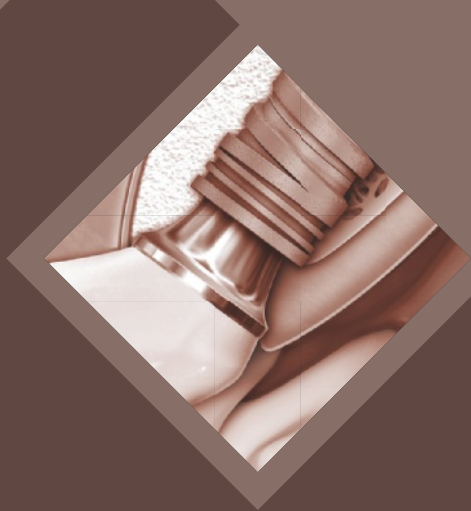
To our partners and employees of SCOE and Marcantonio Continuing Education

To the deans, presidents, coordinators, teachers, colleagues, staff, and students of our partner institutions

To the Napoleão Publishing House – Quintessence Publishing Brazil

To God

Thank you all for your support in the creation of this work.



1 ESTHETIC AND FUNCTIONAL PLANNING: clinical and digital resources

024

Fausto Frizzera, Bianca Vimercati, Hindra Colodetti, Marco Masioli, Jamil A. Shibli, Elcio Marcantonio Jr

2 GINGIVAL CONTOUR IN THE ESTHETIC ZONE: treatment for short clinical crowns

060

Fausto Frizzera, Cristiano H. Pascoal, Rodrigo Nahas, Giuseppe A. Romito, Rubens M. de Freitas, Elcio Marcantonio Jr

3 ROOT COVERAGE IN ESTHETIC REGIONS: treatment of long clinical crown

110

Fausto Frizzera, Cristiano H. Pascoal, Jamil A. Shibli, Luis M. Calderero, Rodrigo Nahas, Giuseppe A. Romito

4 TREATMENT PLANNING IN IMPLANT DENTISTRY: the search for predictable result

162

Fausto Frizzera, Bianca Vimercati, Marco Masioli, Jamil A. Shibli, Camila C. Marcantonio, Elcio Marcantonio Jr

5 SOCKET PRESERVATION: how to maintain tissue architecture

206

Fausto Frizzera, Vítor M. Sapata, Ronald E. Jung, Elcio Marcantonio Jr, Jamil A. Shibli

6 IMPLANT PLACEMENT IN FRESH SOCKETS: how to get an ideal position

250

Fausto Frizzera, Luiz Guilherme Freitas de Paula, Ana Carolina M. Marcantonio, Camila C. Marcantonio, Jamil A. Shibli, Elcio Marcantonio Jr

7 IMMEDIATE PROVISIONAL ON TEETH OR IMPLANTS:

determining chronology and restoration contouring

274

Mateus R. Tonetto, Fausto Frizzera, Eduardo Fernandez, Camila Lorenzetti, Matheus C. Bandéca

**IMMEDIATE REHABILITATION OF INTACT AND
COMPROMISED SOCKETS:**
a predictable protocol

Fausto Frizzera, Jamil A. Shibli, Ana Carolina M. Marcantonio, Elcio Marcantonio Jr. **312**



9 **TREATMENT OF ESTHETIC COMPLICATIONS AROUND
IMPLANTS:**
the decision between keeping or removing an implant

354

Guilherme J. P. Lopes de Oliveira, Fausto Frizzera, Adriano Piattelli, Jamil A. Shibli,
Elcio Marcantonio Jr

LONG-TERM FOLLOW-UP OF IMPLANTS:
what should be expected

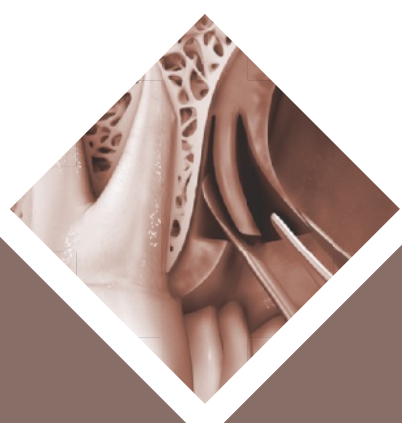
10

Judith M. P. Ottoni, Susana d'Avila, Gabriela C. de Castro, Fausto Frizzera, Ulisses Dayube, Jamil A. Shibli **386**

11 **AVOIDING ESTHETIC AND FUNCTIONAL DEFECTS ON
IMPLANTS:**
how to condition the transition zone

418

Fausto Frizzera, Guilherme J. P. Lopes de Oliveira, Deise Lima Cunha, Daniel S. Thoma,
Jamil A. Shibli, Elcio Marcantonio Jr



CONTENT

Copyright © 2022
not for publication
Quintessence

CHAPTER 1

ESTHETIC AND FUNCTIONAL PLANNING

clinical and digital resources

Fausto Frizzera, Bianca Vimercati, Hindra Colodetti,
Marco Masioli, Jamil A. Shibli, and Elcio Marcantonio Jr



1. INTRODUCTION

The evolution of dentistry in recent decades has been rapid and remarkable. Every moment a new technique is described, mastered, and popularized. In the not-too-distant past, dental treatment consisted of seeking pain relief; often extracting the tooth was considered the most effective treatment. With the understanding of the importance of maintaining dentition for the correct functioning of the stomatognathic system and general health of the individual, dentistry focused on stopping the progression of caries, periodontal diseases, and occlusal disorders.

Contemporary dentistry seeks the preservation and restoration of teeth, periodontal tissues, and peri-implant tissues, with an appropriate relationship between the arches. The treatment philosophy should focus on the restoration of dentofacial function and esthetics to provide or restore the patient's physical, mental, and social well-being, improving their quality of life.

Often dissociated, esthetics and function are integral parts of the same system. They must act synergistically

to provide greater predictability and longevity to dental treatments.

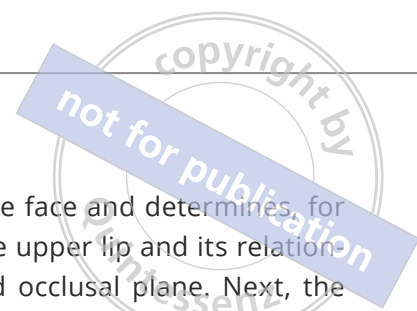
Restorative materials have evolved to reproduce the characteristics of teeth accurately. However, periodontal and peri-implant tissues need a much higher dedication from the dental professional for their reconstruction; preservation is key to avoiding the need for future more invasive and sometimes less predictable procedures. Comprehensive understanding and reconstruction of the biological and functional characteristics of periodontal and peri-implant tissues is challenging and requires interaction between specialties to achieve the expected results. Nevertheless, it is necessary to be sensitive to achieve perfect harmonization of a smile.

In the field of esthetics, many subjective components are linked to ethnicity, belief, culture, age, and individuality. However, there are rules and parameters that, when observed, become a good starting point for the dentist to develop a clinical and digital plan of the rehabilitating treatments. Digital Smile Design (DSD) is a tool that facilitates the diagnosis of changes, planning, and interpersonal communication, guiding professionals to obtain more feasible results¹.

OBJECTIVES

At the end of the chapter the reader should be able to:

- Understand the facial, dental, and periodontal aspects that guide esthetics in dentistry.
- Identify the presence of esthetic changes and the need for multidisciplinary treatments to obtain the expected result.
- Understand the importance of planning and communication with the patient and other professionals involved in treatment.



2. PLANNING BASED ON CLINICAL EVIDENCE

2.1. FACIAL ANALYSIS

When we refer to esthetics, we have to take into consideration that the concept of beauty is broad and generates diversity. Thus, we cannot generalize the criteria to be evaluated. However, there are essential elements that determine facial harmonies, such as planes, lines, and contours, as well as the eyes and smile. From these analyses, planning should take into account esthetic and functional parameters according to the patient's needs.

The first analysis performed when observing the face is its outline (Figs 01A–C). The facial contour

consists of the curves of the face and determines, for example, the support of the upper lip and its relationship with the lower lip and occlusal plane. Next, the field of vision usually shifts to two areas: the smile and the eyes. Other details, such as the nose and hair, are observed later.

The face can be classified into four different types: triangular, square, round, and oval (Figs 01D–G). The proportions between the various planes of the face (frontal and lateral) are important to define facial proportionality and esthetics². In addition, the face can also be divided into three thirds: upper, middle, and lower. A series of face planes were created to allow comparisons and provide guidance.



01. A–G Facial contour: frontal view (A); mid-profile (B); and profile (C). Types of face: triangular (D); square (E); round (F); and oval (G).

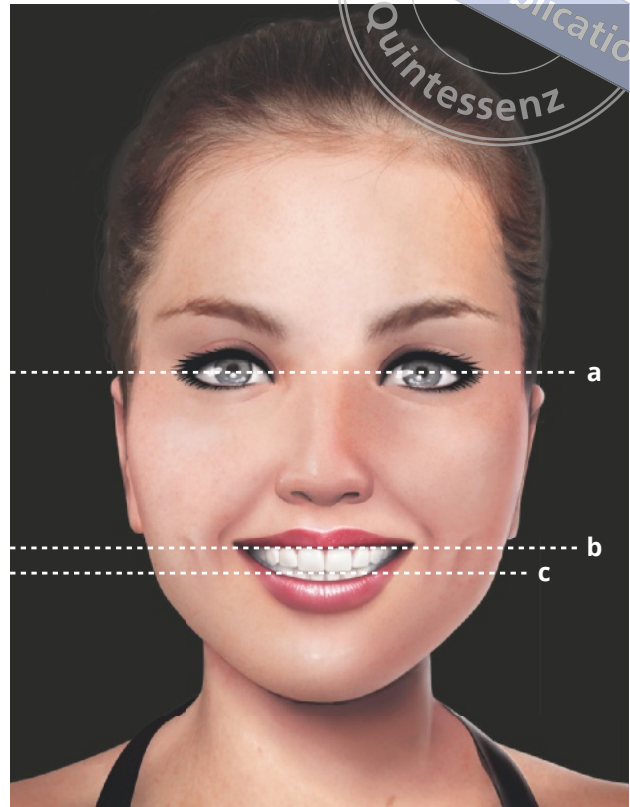
2.1.1. FACIAL PLANES

The facial planes consist of lines and contours and can be horizontal or vertical. The horizontal lines pass through different facial points, such as the pupils and the lip commissure (Fig 02). The parallelism between these lines generates harmony.

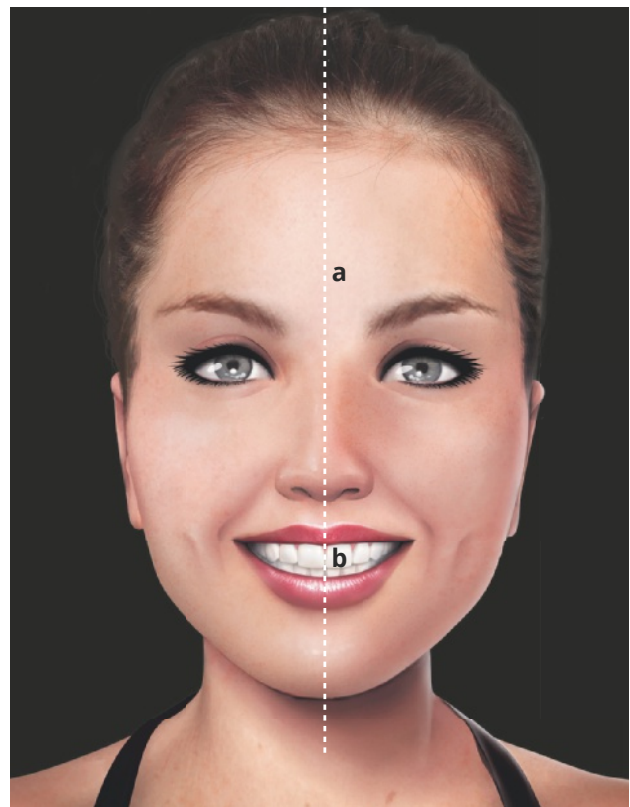
The interpupillary line is a horizontal line drawn over the center of the eyes in the pupil. It should be parallel to the line of the labial commissures, the incisal plane, and the gingival line. This line makes it possible to evaluate the direction of the incisal line and gingival contour of the maxilla^{2,3}. A slight discrepancy between the interpupillary and the intercommissural line is not esthetically relevant. However, if it is a significant discrepancy, it should be corrected.

The incisal plane must follow the contour of the lower lip³; its relationship to the gingival contour of the upper teeth can diagnose mild, moderate, or severe inclination of the maxilla. Planning procedures to correct a gummy smile require evaluation between the planes/facial lines, the relationship between the middle and lower third of the face, and the length and mobility of the upper lip. This evaluation aims to avoid misdiagnosis and, consequently, treatment failure. It usually requires multidisciplinary interventions such as orthodontics, oral and maxillofacial surgery, periodontics, and even esthetic medicine/dentistry with botulinum toxin application or hyaluronic acid fillers.

The most important vertical lines to evaluate facial esthetics are the midline and the interincisal line (Fig 03). The first passes through the nasion and philtrum, and the second passes between the central incisors. There are reference points for drawing the facial midline (such as the glabella, tip of the nose, upper lip philtrum, and chin), which divides the face into two parts. This line helps in the evaluation, location, and orientation of the interincisal line; changes in it may compromise the balance of other facial structures, thus impairing esthetics⁴⁻⁶. Coincidence of the facial midline and interincisal line occurs in 70.4% of the population⁷. Esthetically, the midline serves to assess the location and orientation of the interincisal line. The parallelism between them is more critical than their distance.



02. Horizontal lines and facial planes: interpupillary line (a); intercommissural line (b); and incisal plane (c).



03. Vertical lines of the face: midline (a) and interincisal line (b).



04. A-C Smile lines: low **(A)**, exposure of less than 75% of the maxillary anterior teeth, no exposure of the gingival tissues; intermediate **(B)**, exposure of 75–100% of the maxillary anterior teeth, may expose the papilla; high **(C)**, exposure of the entire length of the maxillary anterior teeth, exposure of a band of gingival tissue.

The occlusal plane is determined by the incisal edges of the anterior teeth and the occlusal surfaces of the posterior teeth. The outline of the lips serves as a guide to determine the length and position of the teeth. Movement of the upper lip determines the smile line of the patient. The range of motion and amount of dental and gingival exposure will depend on several factors, such as the degree of muscle contraction, periodontal tissue level, skeletal conditions, and tooth shape and wear.

2.1.2. LIPS AND SMILE LINE

In general, with the upper lip at rest position, exposure of the central incisors ranges from 1 mm to 3 mm. Women usually expose more teeth than men; with aging the incisal edges of the maxillary central incisors become less visible because the natural process of tooth wear occurs, accompanied by decreased muscle tone and amplitude.

The lips define and structure the smile, besides delimiting the so-called esthetic zone. The lips can be broad, medium, or narrow in form⁷. They can also be classified according to gingival exposure into high, intermediate, or low smile line **(Figs 04A–C)**. The high smile line reveals the full length of the maxillary anterior teeth, as well as a band of gingival tissue. If this gingival exposure is greater than 3 mm, the patient has a gummy smile. The intermediate smile line shows from 75% to 100% of the length of the maxillary anterior teeth and may show the gingival papillae. A low smile line exposes

less than 75% of the maxillary anterior teeth, without exposure of gingival tissue. From an esthetic point of view, the intermediate smile line is the most pleasant^{7–12}.

A pleasant smile should expose the maxillary teeth and a small band of gingiva and papillae **(Fig 05)**. Over time, muscle tone decreases and the gingival exposure tends to decrease, even leading to no exposure of the maxillary incisor crown in older patients, and that may become a complaint.

The relationship between the incisal edge of the maxillary teeth and the lower lip usually occurs in three ways **(Figs 06A–C)**. The first and most pleasant occurs when the incisal edges of the maxillary teeth follow the curvature of the lower lip when the patient smiles. The second occurs when the incisal edges are straight, giving the patient a straight smile. The third, when the incisal edges are reversed in relation to the lower lip, gives the patient an inverted or ‘sad’ smile.



05. Exposure of maxillary central incisors, lateral incisors, canines, premolars and gingival tissue resulting in a pleasant smile.



06. A-C Relationship between the incisal edge of the maxillary anterior teeth and lower lip: the incisal edges follow the curvature of the lower lip (**A**); the incisal edges are aligned with the lower lip (**B**); the incisal edges are inverted in relation to the lower lip (**C**).

2.2. DENTAL ANALYSIS

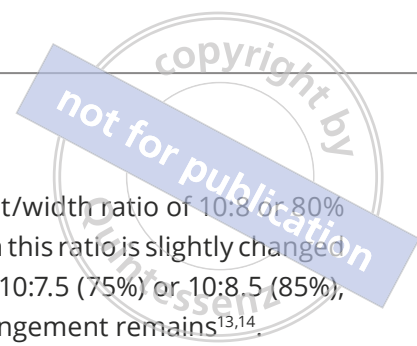
2.2.1. SHAPE

The definition of a pleasant smile is that the maxillary central incisors are deemed the focal teeth due to their location in the dental arch, being the most dominant and visible. Thus, in esthetic rehabilitation, they should be the reference to determine the characteristics of the other teeth. The shapes of the maxillary central incisors are commonly classified as triangular, squared,

and oval^{13,14} (**Figs 07A-C**). The triangular shape of the maxillary central incisor is the most frequent, followed by the square and, less frequently, oval shape. For the complete assimilation of dental morphology, it is essential to have a detailed observation of all surfaces in different views. The incisal view allows the observation of morphological changes that occur from the facial to the proximal surfaces; lateral visualization allows the observation of the cervical, mid, and incisal planes (**Figs 07D, E**).

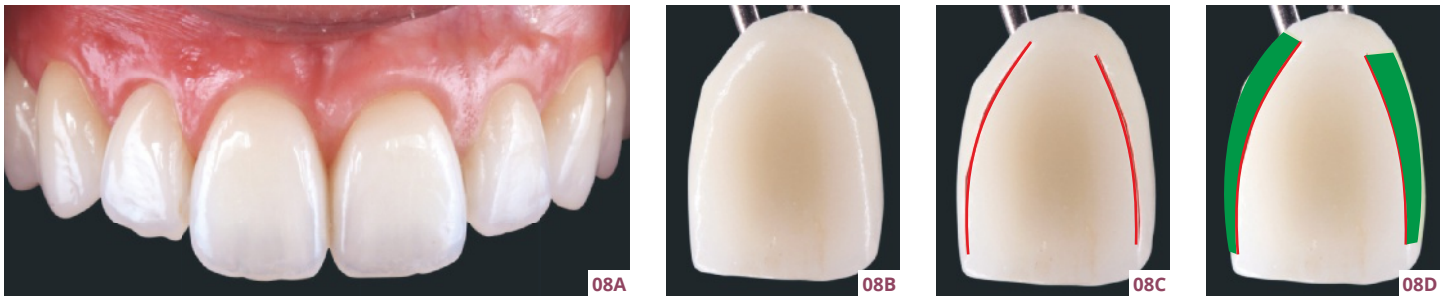


07. A-E Incisor shapes: triangular (**A**), squared (**B**), and oval (**C**). Incisal view (**D**) – allows the observation of morphological changes that occur from the facial to the proximal surfaces. Proximal view (**E**) – allows the observation of the cervical, mid, and incisal planes.



The flat area on the facial surface of the central incisor is primarily responsible for the reflection of light and, consequently, for the appearance of the teeth. It may vary in shape, size, and location (Figs 08A–D). The concept of proportionality suggests that the upper

central incisors have a height/width ratio of 10:8 or 80% (Figs 09A–C). However, when this ratio is slightly changed (Figs 10A–D) in the order of 10:7.5 (75%) or 10:8.5 (85%), an esthetically pleasing arrangement remains^{13,14}.



08. A–D Light reflection area on the anterior teeth (A). These characteristics should be reproduced in esthetic restorations (B). The flat area is principally responsible for light and tooth appearance; it is the area between the facial line angles (red lines) (C). Between the proximal surfaces and line angles is an area called the proximal transition (D). Ceramic crown done during the Clinical Prosthesis Course at FAESA with supervision of Prof George Alves (B–D).



09. A–C Concept of proportionality: the maxillary central incisor should have a height to width ratio of 10:8 or 80%.



10. A–D Alteration in the dental proportion and asymmetry between homologous teeth (A). Surgical procedure performed to intentionally keep the discrepancy in the gingival contour (B). Appearance after tissue healing (C) and immediately after restorative therapy (D). Surgical procedure: Dr Fausto Frizzera; restorative procedure: Dr Marco Masioli.

2.2.2. TEXTURE (MACRO- AND MICROMORPHOLOGY)

Surface texture is a significant factor in the appearance of teeth because it creates different forms of light reflection (Figs 11A, B). Two types of texture are considered: (1) horizontal, which consists of horizontal perikymata that tend to disappear with wear of the facial surface of the teeth; (2) vertical, consisting mainly of developmental lobes and grooves on the facial surface. The incisal edge usually has three lobes (mesial, central, and distal) and two interposed grooves (mesial and distal)¹⁴.

The texture of teeth changes over time because of enamel wear due to physiological activity. Texture can be associated with age. In young patients, teeth have more surface texture; in middle-aged patients, surface characteristics are less pronounced and usually more polished; and in elderly patients, surface characteristics are slight. Also, a higher degree of polishing usually occurs due to toothbrush abrasion, eating, and lip action¹⁴.

Although there is a correlation between age and surface shine, this may vary from person to person, being influenced by physiological factors, degree of tooth mineralization, eating habits, and oral hygiene.

It is important not to confuse texture with surface shine. Some teeth may present little texture and high shine, just as other teeth may have heavy texture and high shine¹³.

2.2.3. INTERDENTAL RELATIONSHIP

The interdental relationship is as essential as the individual assessment of each tooth. Therefore, contact between the central incisors, symmetry, position of the incisal edges, width, contact points, and embrasures should be taken into consideration for the treatment plan of esthetic rehabilitations.

After the individual evaluation, the relationship between the central incisors and the other teeth, and with the face, should be verified. Ideally, the contact between the maxillary central incisors should be linear, straight, and transverse to the horizontal plane and coincident with the midline of the face (Figs 12A–C). However, even in cases where it is not possible to match the



11A



11B

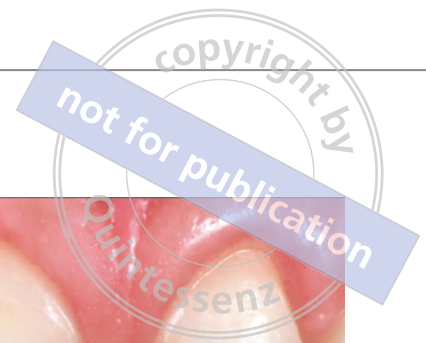
11. A, B Surface texture of teeth in a young (A) and an elderly (B) patient. Textures tends to disappear with age and wear of the buccal surface. Images provided by Dr Matheus Bandéca.

facial midline with the dental midline, contact between the maxillary central incisors should always be parallel to the facial midline.

Anterior homologous teeth should have symmetry in a frontal view (Figs 12D, E). The closer to the midline, the more desirable this symmetry. Thus, the maxillary central incisors should be as symmetrical as possible. Symmetry in the other teeth is desirable; however this need decreases as the teeth move away from the midline¹³.



ROOT COVERAGE PROCEDURE IN A
SINGLE AND DEEP RECESSION USING
STRAUMANN MUCODERM®



12. A-E Types of contact between the maxillary central incisors: aligned to the horizontal plane (**A**); not aligned to the horizontal plane (**B**); absence of contact between the maxillary central incisors with presence of a diastema (**C**). Symmetry (**D**) and asymmetry (**E**) between homologous teeth.

In a pleasant smile, the incisal edge of the maxillary lateral incisors is, on average, 1 mm more apical than the edge of the central incisors. The incisal edges of the canines are in the same plane or slightly more apical than the incisal edges of the central incisors.

The interdental contact of the maxillary anterior teeth descends from the canine toward the central incisors (**Fig 13**). The contact between the canine and lateral incisor is more apical than the contact between the lateral and central incisors. The contact between the central incisors is more incisal than the contact between the lateral and central incisors. These contact points are usually tight unless there is a mesiodistal discrepancy of the crown, with the presence of diastemata between the teeth^{15,16}. The position of the interdental contact is related to the position of the tooth in the arch and its morphology¹⁷. In a buccal or lingual view, it is possible to observe the gingival and incisal embrasures. The gingival embrasure, which houses the

interdental papilla, is delimited by the contact point, adjacent teeth, and bone crest. The incisal/occlusal embrasure is delimited by the contact point, incisal angles, and by an imaginary line from the end of each incisal angle.



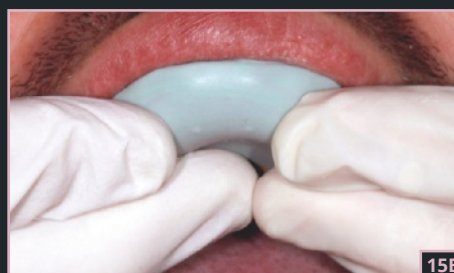
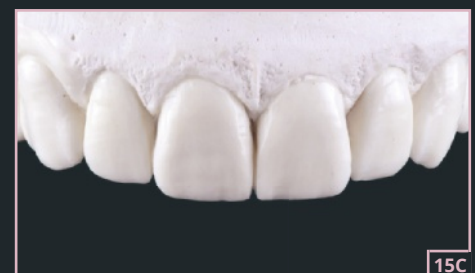
13. Contacts between anterior teeth (lateral view).

The analysis of the incisal embrasure is a crucial factor for the planning of esthetic rehabilitation of anterior teeth. The pattern of the shape produced by the incisal embrasures and separations between the maxillary anterior teeth with the darker background of the mouth

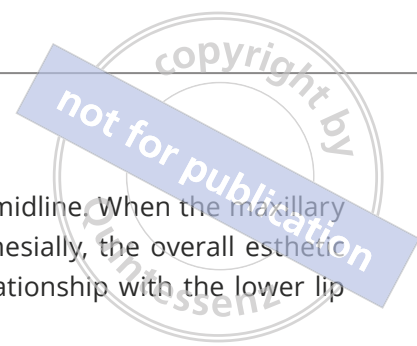
helps to define a pleasant smile. The spaces between the embrasures follow a pattern that begins between the central incisors and progresses distally. Incisal embrasures increase in size and volume as they move away from the midline¹⁸ (Figs 14 and 15A-F).



14. The incisal embrasure between the central and lateral incisors should be bigger than the incisal embrasure between the central incisors. The same aspect as the incisal embrasure between the canine and lateral incisor should be bigger than the incisal embrasure between the lateral and central incisors.



15. A-F The shape of the embrasures and the interproximal contact should be considered because they influence the smile esthetics (A, B). Diagnostic wax-up of the patient with the appropriate shape of incisal embrasures can be used to visualize a greater harmony between the anterior teeth (C). The result obtained with the wax-up allows performing a mock-up, where a putty matrix is made from the waxed model. Then, bis-acrylic resin is dispensed into the matrix (D) and then positioned into the patient's mouth (E). After the resin cures, the matrix and excess are removed. The dentist and patient can evaluate the proposed changes in the of anterior teeth (F). Restorative procedure: Dr Mateus Tonetto.



2.2.4. DENTAL AXIS

The inclinations (facial-lingual positioning) and angles (mesiodistal positioning) of the anterior teeth correspond to the dental axis. The anterior and posterior teeth present a positive angulation of the buccal axis of the clinical crown, that is, the occlusal portion of the buccal axis is positioned more mesially to the gingival portion. These angles should increase from the maxillary central incisors toward the maxillary canines. The opposite happens with the inclinations, which decrease from the maxillary central incisors toward the canines^{15,16} (Figs 16A, B and 17A, B). The long axis or direction of the anterior teeth in an esthetic smile follows a progression

as it moves away from the midline. When the maxillary anterior teeth are angled mesially, the overall esthetic impact is a harmonious relationship with the lower lip curvature¹⁹.

The inclination of the maxillary incisors can be assessed by analyzing the buccal surface of the existing maxillary central incisors relative to the patient's maxillary posterior occlusal plane. The buccal surface of the maxillary central incisors should be perpendicular to the upper occlusal plane (Figs 18A–C). This ratio allows maximum direct light reflection from the buccal surface of the maxillary central incisors, which improves their esthetic appearance²⁰. If the teeth are reclined or inclined, esthetics may be impaired and require correction.



16. A, B Adequate (A) and inadequate (B) angulation; note the right maxillary lateral incisor.



17. A, B Adequate (A) and inadequate (B) inclination of the maxillary anterior teeth.



18. A–C Maxillary central incisor with the facial surface perpendicular to the maxillary occlusal plane (A); note the central incisor dominance (B) and adequate light reflection (C).

2.2.5. DOMINANCE AND REGRESSIVE APPEARANCE PROPORTION

Dominance refers to the fact that the maxillary central incisors should be the dominant teeth and most visible when smiling. The curvature of the dental arch shows less of the teeth in the distal position. The less a tooth is visible, the less its importance on the smile. The maxillary central incisors, because of their position in the center of the arch, should appear as the widest and whiter ones and, consequently, are the predominant teeth in the frontal aspect (Fig 19A).

The width of the maxillary central incisor is dependent on its height. The other teeth, on the other hand,

depend on the width of the maxillary central incisors. An esthetic proportion with regard to the relationship between teeth is when the extent of the visualization decreases from the central incisor to the posterior teeth by 1:0.618. This ratio is called the 'golden' or divine proportion and refers to the apparent width of the teeth when viewed frontally. Thus, starting from the central incisor, each tooth appears to have 61.8% of the width of the tooth located to its mesial aspect (Fig 19B).

The golden proportion is not always found in the dental composition of the general population and should not be applied to all patients. It should be used to guide esthetic evaluations and rehabilitations (Figs 20A, B).



19A



19B

19. A,B When viewed frontally teeth should be gradually less visible from the center toward the posterior region (A). The golden proportion determines the width of the other teeth, with the central incisors as a reference. An approximate reduction of 61.8% of the width of the maxillary central incisor in relation to the maxillary lateral incisor should exist. For example, if the central incisor is 1-cm wide, the lateral incisor must be 0.618 cm; the canine should be 0.38-cm wide, and so on (B).

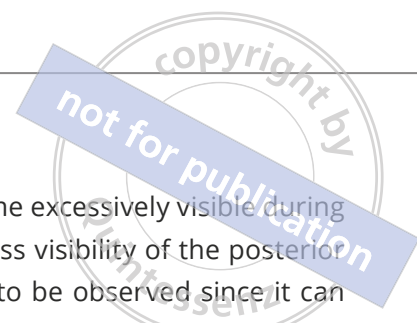


20A



20B

20. A,B The alteration in teeth proportion can occur unilaterally (A) or bilaterally (B). Unilateral asymmetries generally require a more complex treatment.



2.2.6. BUCCAL CORRIDOR SPACE

The buccal corridor is the space between the buccal surface of the upper teeth and the cheek’s mucosa that form the corner of the mouth and cheek. It is dependent on the width of the upper arch and the facial muscles responsible for the width of the smile²¹.

In a wide smile, the area and number of maxillary posterior teeth that show are visible be considered. In patients with a narrow arch and wide smile, the teeth displayed after the canines may be in the shadow or disappear entirely. This condition is called a deficient buccal display²². Reduced buccal exposure can have negative esthetic consequences in some patients.

On the other hand, buccalized teeth or overcontoured restorations and dentures that invade the space

of the buccal corridor become excessively visible during the smile (Figs 21A, B). Excess visibility of the posterior teeth is an essential factor to be observed since it can have negative esthetic consequences; thus, it should be evaluated during treatment^{5,21}.

Dental characteristics are usually assessed qualitatively to verify the presence of symmetry, color, and harmony (Figs 22A–C). One quantitative method used to measure dental esthetics is the White Esthetic (WES)²³. The contralateral tooth is the object of comparison and the maximum score of this evaluation is 10, indicating esthetic excellence (Figs 23A–C and Table 01). If values lower than 6 are determined, dental esthetics are classified as clinically unsatisfactory. Satisfactory scores are greater than or equal to 6.



21A

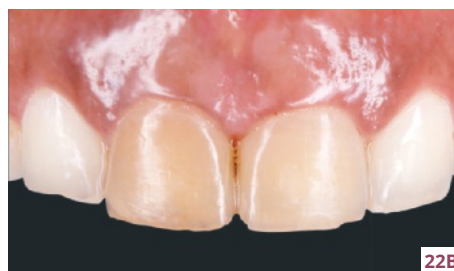


21B

21. A, B Adequate (A) and inadequate (B) buccal corridor, where the posterior teeth invade the buccal corridor space and are more visible.



22A



22B

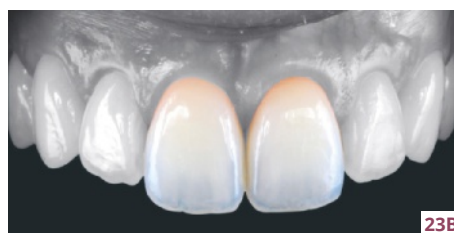


22C

22. A–C Maxillary central incisors with adequate (A) and altered (B) color or high translucency (C).



23A



23B



23C

23. A–C WES analysis should be performed by choosing a tooth and comparing it with its homolog (A,B). Shape (1), volume/contour (2), color (3), texture (4), and translucency (5) are compared and a score is assigned to each of these factors (C).



MODIFIED WES			
Parameter	Major alteration	Minor alteration	No alteration
1- Shape	0	1	2
2- Volume/contour	0	1	2
3- Color	0	1	2
4- Texture	0	1	2
5- Translucency	0	1	2
Maximum total value of WES			10

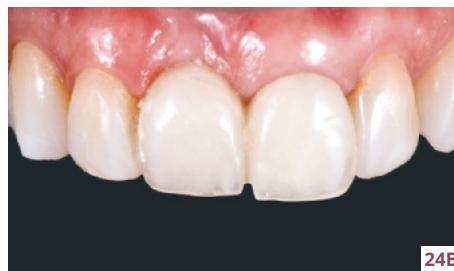
Table 01 Variables evaluated by the WES and their respective scores (0, 1, or 2). Minimum total value = 0, maximum total value = 10

2.3. THE RELATIONSHIP BETWEEN TEETH AND GINGIVA

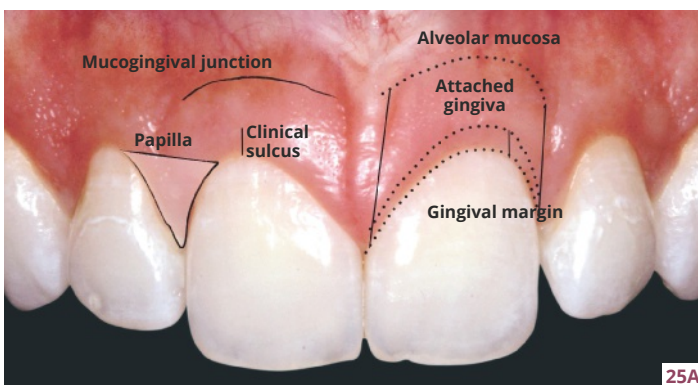
The interaction between teeth and gingival tissue is an integral part of the esthetics of the smile. The red esthetics relate to periodontal health, the alignment of the gingival margins, and the presence of the papillae. The papillae should fill the entire gingival embrasure, avoiding the occurrence of black spaces. In situations where periodontal or peri-implant tissue discrepancies are present, it may be necessary to intervene in

the soft tissue architecture (Figs 24A–C). The anatomy and structure of periodontal and peri-implant tissues should be known to prevent injury or detect changes (Figs 25A, B):

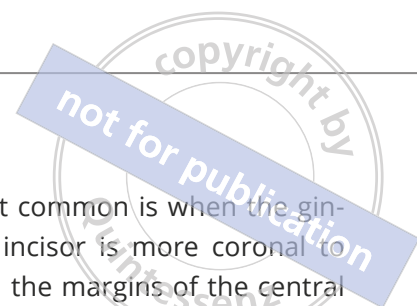
- Gingival margin
- Clinical sulcus
- Attached gingiva
- Mucogingival junction (MJ)
- Alveolar mucosa (AM)
- Papillae



24. A–C In addition to dental characteristics, it is important to analyze the appearance of soft tissue, which may present an excess (A), may be missing (B), or may present changes in color/texture (C).



25. A,B Anatomical components of the gingiva in frontal (A) and lateral view (B).



The gingiva has a pinkish-reddish color, opaque surface, and firm consistency in a healthy periodontium²⁴. The gingival margin has a parabolic contour and its most apical point is called the gingival zenith. This shape is determined by the dental axis and buccal cervical contour. Pre-established esthetic principles are used to guide the position that the gingival margin of the anterior teeth should have. It is necessary to consider the importance of establishing harmony between periodontal esthetic components²⁵.

2.3.1. GINGIVAL ZENITH

In frontal view, the gingival zenith of the central incisor and maxillary canine is shifted distally; the zenith of the lateral incisor is located slightly distal or coincident with the long axis of the tooth. This is important in rehabilitations involving the entire buccal surface of the tooth. In esthetic treatment, orthodontics or periodontal surgeries can be performed to re-establish the location and relationship between the zeniths. However, the dental phenotype, that is, the shape of the tooth, influences the contour of the gingival zenith. Triangular teeth tend to have a more pronounced zenith compared to square-shaped teeth^{13,14,25}.

The positioning of the gingival contour should follow the contour of the upper lip and may be on the same level or slightly hidden under it. Gingival contour changes are critical when they affect the central incisors. On the other hand, small variations in the gingival contour of the other teeth are more acceptable, resulting in a natural smile.

2.3.2. RELATIONSHIP BETWEEN GINGIVAL TISSUES AND MAXILLARY ANTERIOR TEETH

The relationship between the gingival margins of the maxillary anterior teeth can follow two esthetically

pleasing contours. The most common is when the gingival margin of the lateral incisor is more coronal to the tangent drawn between the margins of the central incisor and canine on the same side. Another possible harmony in gingival contour is when the gingival margins of the central incisors, lateral incisors, and canines on the same side are aligned on the same tangent^{13,14,25} (Figs 26A, B).

An unattractive gingival contour occurs when there are asymmetries or when the gingival margin of the lateral incisor is apical to the tangent drawn between the margins of the central incisor and canine on the same side (Figure 27). To correct the position of the gingival margin due to its coronal or apical migration, orthodontic or periodontal procedures may be indicated (Figs 28A, B).

The gingival margin is typically positioned at 1–2 mm from the cemento-enamel junction (CEJ). Insertion of a periodontal probe between the gingival margin and the tooth is used to measure the probing depth of the gingival sulcus. Increased values (> 4 mm) of probing depth (PD) associated with periodontal bleeding and possible changes in color and volume due to inflammation denote the presence of periodontal pathology²⁴. Its treatment through basic periodontal therapy should precede any dental intervention. The goal is to obtain a clinical PD between 1 mm and 3 mm, with no periodontal bleeding and inflammation (Figs 29A, B). However, under more severe conditions, it may not be possible to obtain these results immediately at the end of treatment, so surgical techniques, reinterventions, or complementary procedures (Figs 30A–G) may be applied to ensure the desired periodontal health²⁶.

Apical migration of the gingival margin with root surface exposure may occur after periodontal treatment or because of physiological changes and mechanical trauma²⁷. This condition is known as a gingival recession (GR)



26. A,B Gingival margin of the maxillary lateral incisors more coronal in relation to the gingival margin of the canines and central incisors (A). Gingival margin of the maxillary lateral incisors at the same level of the gingival margin of the canines and central incisors (B).

copyright by
not for publication
QuintessenZ



27. Asymmetry of gingival margins due to loss of tooth 21 and orthodontic movement of the remaining anterior teeth to mesial to close the space. Due to the difference in root width between the contralateral teeth (11/22 and 12/23), treatment of this alteration by surgical and restorative procedures only is.



28A



28B

28. A,B Patient with multiple gingival recessions (A) treated with a periodontal procedure of root coverage (B).

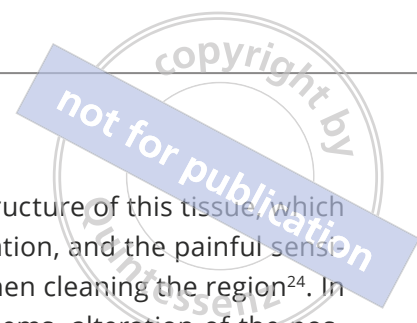


29A



29B

29. A,B Patient gummy smile (A) who was treated with crown lengthening surgery (B).



and is measured by the distance between the CEJ and the gingival margin. Another change in the position of the gingival margin is the coronal migration of the gingival margin, above the CEJ, which characterizes the presence of gingival hyperplasia (GH). The evaluation of the gingival level (GL) and PD aims to verify the clinical attachment level (CAL) of longitudinal periodontal control of the patient (Figs 31A, B). CAL is calculated by adding to (recession site) or subtracting (GH site) from the PD value. The amount of gingival attachment is determined by the

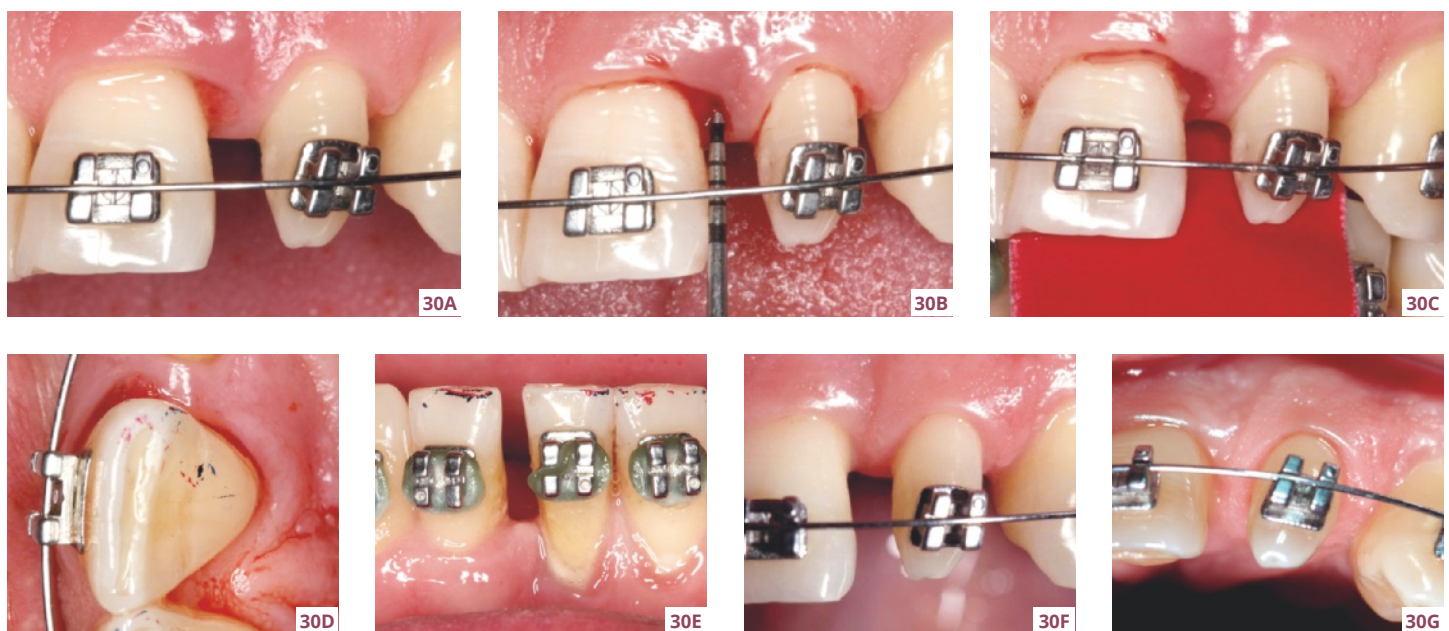
$$CAL = PD \pm GL \text{ (GR or GH)}$$

distance between the bottom of the sulcus and the MJ. This amount varies, depending on the patient, region, and presence of associated pathologies. In the past, the presence of a minimum of 2 mm of attached gingiva was considered necessary for periodontal health. Techniques for increasing this range have been employed extensively with predictable results. Currently, both in teeth and implants, the scientific literature^{28,29} considers that as long as the patient can keep proper hygiene, this minimum range is not necessary for periodontal health (Figs 32A, B). Some studies suggest that in the case implants, the presence of gingival attachment is necessary to avoid peri-implant problems. However, there is still no consensus in the literature³⁰. The major concern when the patient presents with only AM around teeth

or implants is due to the structure of this tissue which is less resistant to inflammation, and the painful sensitivity a patient may have when cleaning the region²⁴. In addition to functional problems, alteration of the position of the AM may cause esthetic changes due to the difference in color and contrast with adjacent tissues (Fig 32C). Despite these adverse factors regarding the AM, it is necessary to pay particular attention to this anatomical component in reconstructive surgical techniques, due to its manipulation in the coronal or apical direction, since its elasticity and nutritional capacity will allow the closure, stabilization, and nutrition of the flap.

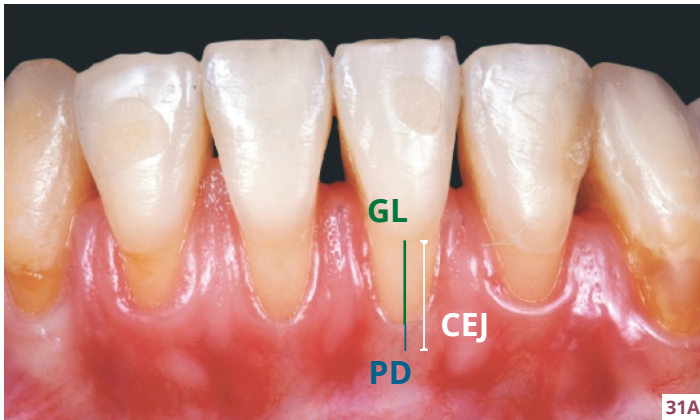
The papilla occupies the gingival embrasure, the space below the interdental contact. Its anatomy is determined by the width of the interproximal space, the anatomy of the CEJ, the emergence profile, and the proximal contact³¹. Because of these characteristics, it has a pyramidal shape in the anterior teeth and a saddle shape in the posterior teeth. In the posterior teeth, the papilla presents as a valley-shaped depression that joins the lingual and buccal papillae²⁴.

In rehabilitative planning, it is necessary to establish a papilla as a reference; the one of choice is usually the papilla between the maxillary central incisors, which should be positioned coronal in relation to the other papillae (Fig 33). The papilla may fill the interproximal space completely, partially, or be absent.

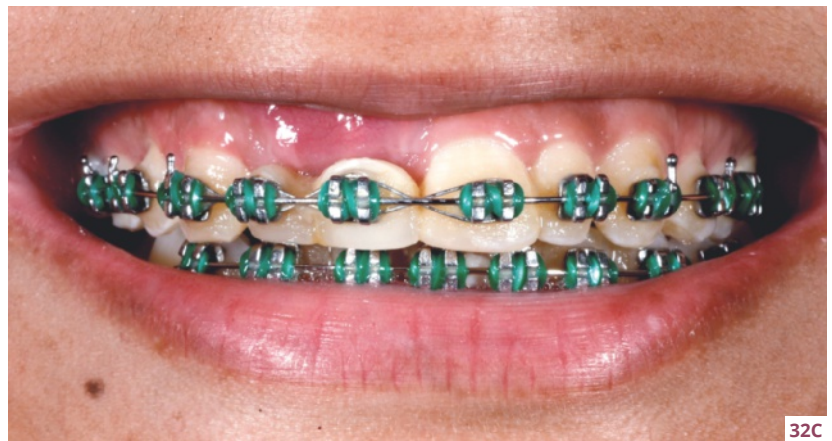


30. A-G A patient referred for periodontal esthetic evaluation (A) before the removal of the maxillary orthodontic appliance had a deep pocket (B) and the presence of premature contacts (C-E). The basic periodontal treatment involved orientation and motivating oral hygiene, scaling and root planning, and occlusal adjustment to obtain periodontal health before any other procedure (F,G).

copyright by
not for publication
Sunlessenz



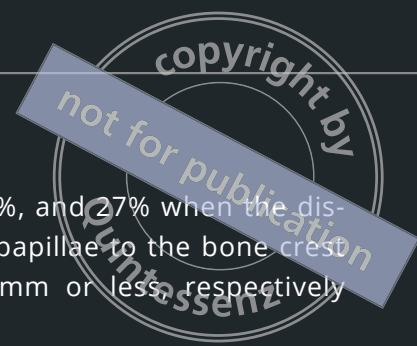
31. A,B The clinical attachment level is determined by the sum (in teeth with recession) or subtraction (in teeth with hyperplasia) of the GL with the PD. Recession (**A**) and gingival hyperplasia (**B**) represent the GL and are measured by the distance between the gingival margin and the CEJ. If neither change exists, the GL is zero.



32. A-C Depending on the region and patient, it may be challenging to remove dental biofilm in areas without attached gingiva. The right mandibular canine region where the patient reported gingival pain and difficulty with brushing (**A**) and left mandibular canine where the same patient reported no discomfort or difficulty with brushing (**B**). Soft tissue color change due to coronal traction of the AM for first intention closure of a flap performed for implantation and grafting with bone and gingival tissue (**C**).

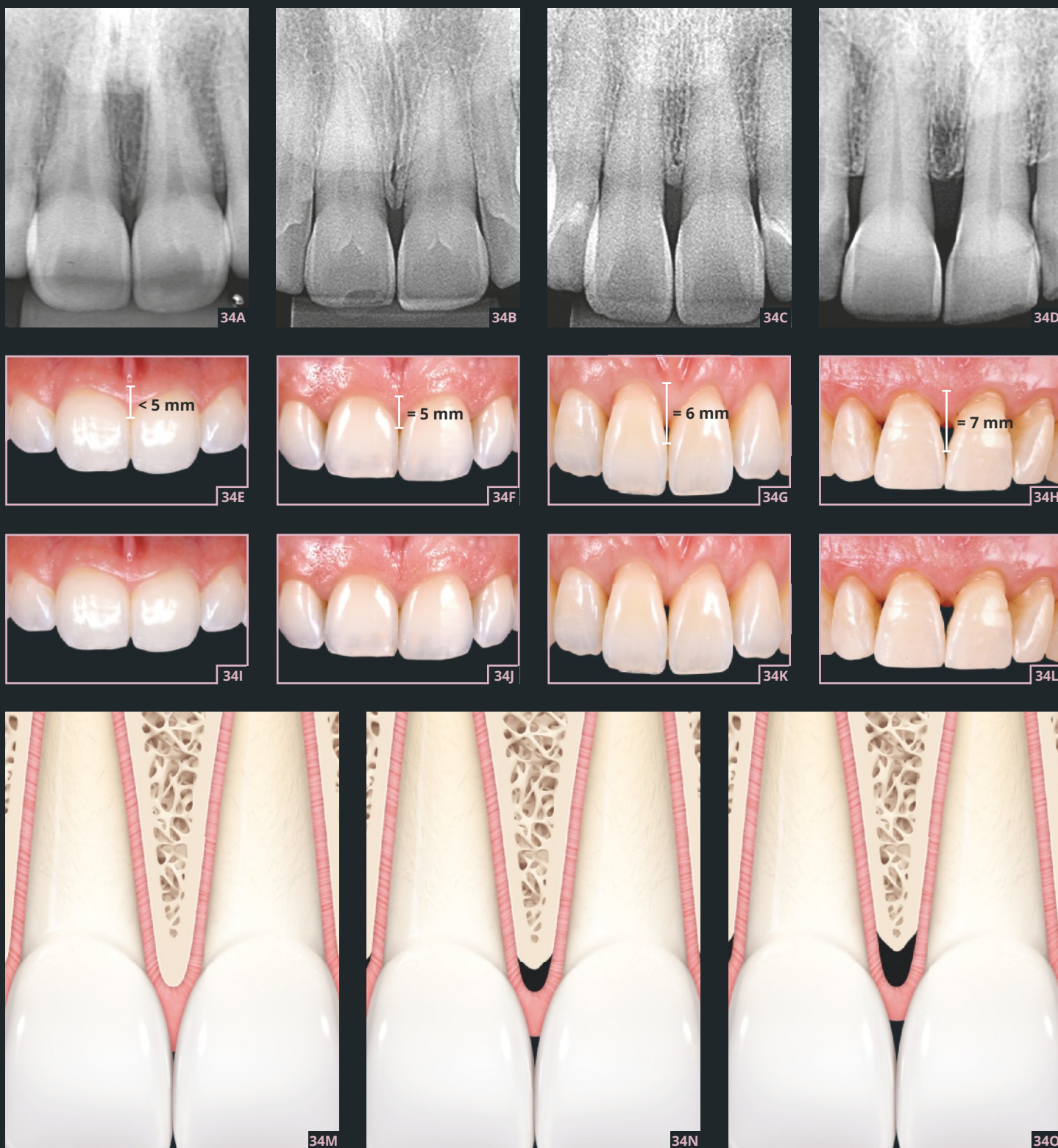


33. The interdigital papillae are higher in the region of the maxillary central incisors, being progressively more apical the further they are from the midline.



Tarnow et al³² demonstrated the importance of the relationship between the contact point and the bone crest to determine the presence of interdental papillae. The gingival papillae filled the embrasure

in its entirety in 100%, 56%, and 27% when the distance from the tip of the papillae to the bone crest was 5 mm, 6 mm, and 7 mm or less, respectively (Figs 34A–O).



34. A–O The relationship between the contact point and the bone crest may influence the amount of soft tissue present in the gingival embrasure. Decreased (**A, E, I**), normal (**B, F, J, M**), or increased distance (**C, D, G, H, K, L, N, O**).

The unique anatomy of the papilla and its terminal vascularization make the reconstruction of this periodontal component extremely difficult. It is the real Achilles heel of periodontal reconstructive techniques. Treatment of papilla loss should be carefully planned. It should consider the position of the bone crest, its relationship to the contact point, and the periodontal and dental condition of adjacent teeth³².

Restorative and orthodontic treatment are more predictable than surgical treatment to improve the appearance of the interproximal region. When the defect is generalized and occurs between the central or both sides, restorative therapy will provide satisfactory

results by re-anatomizing the gingival embrasure and transforming a contact point into a contact area, approximating it to the bone crest (Figs 35A-D).

When the defect occurs unilaterally, restorations alone may not be able to restore the esthetics of the patient successfully. These cases are more challenging to resolve when they happen between the maxillary central incisors. Orthodontic therapy may be necessary to approximate the bone crest to the contact point by slow tooth extrusion. This technique allows the increase of periodontal and bone tissue in height (Figs 36A-C). After the orthodontic movement, restorative and/or surgical therapy may be required to finalize the case.



35A



35B



35C



35D

35. A-D Bilateral papillae defects between central and lateral maxillary incisors (**A, B**). Planning for replacement of restorations should involve modifying the dental anatomy from triangular to square to allow a better esthetic and functional outcome (**C, D**).

Many books include an inherent bias: The authors specialize in a certain beloved technique and attempt to apply this technique to multiple clinical situations while glorifying the successes and dismissing the failures. Or it is written by researchers so wrapped up in science and academia that they forget what it really means to run a dental practice and deal with patients day-to-day. This book is different. The authors have many decades of both academic and clinical experience and have set out to produce a clear, impartial, and rational text to address new concepts and techniques that affect daily clinical practice. Treatments (including their limitations) are described, including many controversial techniques and clinical issues not previously described in the literature. The chapter layout is presented logically and in sequence to address the different specialties in an organized and contextualized way. A comprehensive background is provided to allow readers to determine for themselves – rather than be told – how to best develop a sound clinical work.



ISBN 978-1-78698-098-4



9 781786 980984

www.quintessence-publishing.com