

ESTHETICS IN FUNCTION

INTEGRATING OCCLUSAL PRINCIPLES
INTO SMILE DESIGN

MARCELO A. CALAMITA





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DEDICATION

To my beloved wife Luciana: this work would not have come to fruition without the unwavering support you have graciously bestowed upon me. Your boundless love has been the driving force behind my endeavors, propelling me forward even in the face of challenges. Your love has nurtured my soul, allowing me to grow and flourish in ways I never thought possible.

To my precious children Rafael, Julia, and Leonardo: you have brought a profound and purposeful significance to my life. Your presence has been the catalyst for my personal development, and I am forever grateful for the boundless love and joy you bring to my world.

ACKNOWLEDGMENTS

This work is the culmination of a lifetime of dedicated studies, relentless practice, and profound contemplation, nurtured by the invaluable teachings and thought-provoking questions from my beloved family, esteemed professors, colleagues, and students. Each of these enriching relationships has played a pivotal role in shaping me, both as a human being and as a professional. Their unwavering support and constructive influence have earned my eternal gratitude!

For the preparation of this book, I would like to give special thanks to:

The coauthors, Felipe Miguel Pinto Saliba, Christian Coachman, José Roberto Santana de Moura Junior, Guilherme Cabral, Alexandre Carvalho Teixeira, Eduardo Rodrigues Fregnani, and Wanessa Miranda-Silva for the priceless quality of the work carried out.

To those who donated their precious time and added academic value to this work, being Professors Robert Gray Coachman, Ivo Contin, Paulo Vinícius Soares, Leandro Hilgert, Julio Cesar Joly, Marcos Cesar Pitta, Adalberto de Paula Souza Jr, Gustavo Giordani, Simony Kataoka, Milton Missaka, Estevam Augusto Bonfante, Celso Orth, and Maria Luiza de Moraes Oliveira.

To all the dental laboratory technicians who worked alongside me with determination to exceed the expectations of each patient and who have helped me learn the techniques, possibilities, and limitations of each approach. I would especially like to mention CDT Christian Coachman, CDT Edson Silva, and CDT Diogo Meris Fidêncio, with whom I have had a close collaboration for many years.

To the meticulous work of Editora Napoleão / Quintessence Publishing, with their tireless teams in the pursuit of excellence, namely proofreader Marise Ferreira Zappa, illustrator Daniel Guimarães, graphic designer Deoclesio Alessandro Ferro, and work coordinator Fernando Custódio, in addition to the directors William Napoleon and Leonardo Napoleon.

There is a piece of all of you in these pages!

MARCELO A. CALAMITA



DEDICATION / ACKNOWLEDGMENTS

You are about to embark on an extraordinary clinical journey that will change the way you think about treating patients. There is no better guide than Dr. Marcelo Calamita as you travel this path. This master clinician and extraordinary educator possesses a generosity of spirit and a caring nature that is second to none.

Indeed, what makes *Esthetics in Function* so unique among dental tomes is that it clearly depicts Dr. Calamita's mindset and broad-based treatment philosophy that includes strong interpersonal communications skills, a deep sensitivity to patient needs, and the ability to provide the necessary emotional support, all of which are essential but often missing components in achieving overall treatment success.

With his precise analytical skills and meticulous approach to comprehensive care, Dr. Calamita brings a fresh approach to diagnosis and treatment planning and a new clarity to the kinds of methodologies that can lead to more predictable treatment outcomes. In short, this book will guide dentists in becoming more capable clinicians, with their patients being the true beneficiaries.

With the wealth of resources made available through university education, postgraduate courses, study clubs, dental seminars, and the internet, clinicians are now able to quickly access a vast amount of information that can assist in diagnosis and treatment planning. However, many still have difficulty in recognizing occlusal dysfunction and incorporating the remedies effectively into a comprehensive treatment plan. One of the great strengths of this publication is its focus on the importance of thoroughly understanding the principles of occlusion and occlusal disharmonies as a prerequisite to achieving optimal smile esthetics and successful restorative outcomes.

As founder of Seattle Study Club and editor of two textbooks on interdisciplinary treatment planning, I have devoted much of my professional life to providing practicing dentists a university-like continuing education experience and making an essential connection between aspiring practitioners and top educators such as Dr. Calamita. These clinicians may have their own unique practice philosophies, but the common thread between them is that they have an insatiable thirst for knowledge and want to provide the highest-quality patient care.

However, as dentists become increasingly confident in interdisciplinary and multiphased treatment discussions, there is also a greater need for a systematic approach as new levels of understanding and technology are reached. Dr. Morton Amsterdam (considered the “Father” of Periodontal Prosthesis) has been referenced repeatedly over the years as having proposed that there are many options or ways to treatment plan a case, but there is only one correct diagnosis. The closer we come to attaining an accurate diagnosis, the more successful and sustainable the treatment.

In this regard, *Esthetics in Function* helps clinicians in improving their diagnostic acuity and then prepares them to proceed with a “customized” treatment plan in concert with their patient’s wishes.

Dr. Calamita also addresses many of the challenges that still remain for those committed to implementing a comprehensive treatment approach:

- Where to begin in establishing a meaningful comprehensive treatment plan;
- How to develop an organized, reproducible, and effective way that predictably leads to an accurate case diagnosis;
- Understanding how occlusal dysfunction can affect restorative treatment outcomes and incorporating solutions into the overall treatment plan; and
- Once a case diagnosis has been established, how the interdisciplinary team can work together in developing a treatment plan that will best serve both the treatment team’s abilities and the patient’s desires.

Esthetics in Function is a welcome addition to the body of knowledge that currently exists regarding the often-overlooked relationship between occlusion and esthetics. There is no question in my mind that it will be a much-referenced publication for years to come.



MICHAEL COHEN, DDS MSD FACD

Founder of Seattle Study Club

Author / Editor of two bestselling books on Interdisciplinary Treatment Planning (Quintessence Publishing)



FOREWORD ~ MICHAEL COHEN



I believe that one of the primary shortcuts to success is having the opportunity to interact with true mentors. Even better if these mentors become great friends and partners in life projects.

I have had that privilege. Marcelo is undoubtedly one of the leading names in the exclusive list of people who have directly impacted my career and helped me to become who I am.

Therefore, writing this Foreword fills me with pride and emotion. This happiness is also because I followed the process of creating this book and knew of Marcelo's immeasurable dedication and passion for this work.

This book is a beautiful tribute to ethical, interdisciplinary, high-performance dentistry. It is the summary of a life dedicated to our profession. It combines tireless research and the pursuit of excellence with the determination never to settle for the mediocre. This work is a gift of a great professional to all of us who are passionate about esthetic-functional rehabilitation. I call it a gift because the focus is on actual teaching, the kind that changes behavior, transforms the complex into the simple, helps in the daily decision-making processes, and allows dentists to positively impact the lives of their patients. It is a realistic book that teaches the scientifically based and the clinically feasible, constituting a manual, a tutorial, and a reasoning guide that only true teachers can create.

I met Marcelo in the early 1990s. I had just started college, and at the time, he was working with my father as a prosthodontist at the Keyes-Coachman Institute, a landmark in interdisciplinary esthetic dentistry. I well remember my father praising Marcelo and his bright future. He became his principal collaborator, not only in patient care but also in developing team workflows. With his unique ability to research, organize, and catalog information, Marcelo helped create pioneering protocols that I use to this day to explain modern dentistry concepts, which was fundamental for developing the DSD (Digital Smile Design) concept.

When I became a dental technician, Marcelo became my second client, only after my father. He bet on me before I became a good professional. The brainstorming we have constantly done resulted in my passion for treatment planning and function. He was also my professor of Dental Prosthesis at college (FOUSP) and encouraged me to discover another passion of mine: teaching. We helped each other to find new and better didactic strategies to express our ideas. The first dental book I ever read, while I was still in college, was the classic on occlusion by Peter Dawson, in which Marcelo was part of the Portuguese translation team.

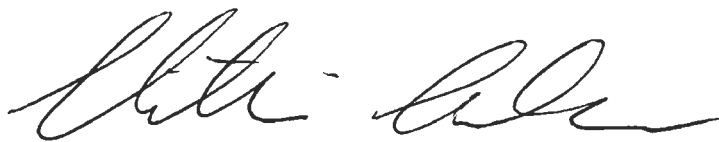
All of the above shows how important my professional and personal relationship with the author of this work is, to the present day. I perfectly remember the outstanding achievements we enjoyed such as proudly representing Brazilian dentistry with joint lectures on stages of great international congresses such as the Seattle Study Club, International Federation of Esthetic Dentistry, and American Academy of Esthetic Dentistry.

I also remember the numerous congresses we attended together and how Marcelo never missed an opportunity to learn. His excellent notes and the way he ascertains, filters, analyzes, organizes, and complements the information presented are unique, and his summaries are robust. I used to call them the “dental encyclopedia,” and this quality is undoubtedly one of the great reasons why this book will be so valuable.

Every time I show our joint work around the world in my lectures, I always mention: “...this case or concept I developed with my great partner, the brother that dentistry gave me and one of the best prosthodontists I know.” I say and repeat this with conviction, and each year, this statement becomes more accurate.

Thank you, Marcelo, for your dedication and willingness to share. Thank you for your friendship and teachings. Thank you for this book and for the honor of writing this Foreword.

We continue on this beautiful journey together.



CHRISTIAN COACHMAN, DDS CDT



FOREWORD ~ CHRISTIAN COACHMAN



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The search for excellence is a continuous process with no predetermined itinerary or specific destination, and it is related to how we can evolve and offer our best daily.

It is a life purpose that transcends any material good and aspires to achieving a fulfilling life on the personal, professional, and spiritual levels.





*"We are what we repeatedly do.
Excellence, then, is not an act, but a habit."*

Aristotle (384–322 BC)

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Everything in life needs a purpose!

With this statement in mind, I began to reflect on the purpose of the present work. Writing a book takes an immense amount of time, more than we can count. It also includes a need for organization, discipline, and enormous efforts, more than we believe we have. I think it is impossible to predict how challenging and demanding the task of materializing all our studies and experiences in words and images will be.

To fully execute this journey, it will be necessary to make it relevant, practical, and uncomplicated. If the current amount of information is immeasurable, it is up to me to refine it with care, consistency, and without bias, to make it available in a practical way to our readers. Thus, these pages are based on an extensive literature review and contain the best-quality scientific evidence available at the time of publication, accompanied, when deemed pertinent, by the author's comments.

This book is not intended to be a closed, complete, or definitive package of information. It suggests an organized system based on a thorough diagnosis that provides rational decision-making and effective personalized treatment planning. The primary objective is to obtain predictability and consistency within a process to be constantly refined according to the abilities of each interdisciplinary team.

The book's central themes – treatment planning and occlusion – are inseparable factors for the success of any restorative treatment and, why not say, for the reputation of a dental clinic in the long term. However, I often observe that perhaps because these topics are not addressed with the necessary clarity and scope, there remains a deficiency in the understanding and practical application of these concepts by clinicians in general, causing frustrations and failures in dental treatments.

From my perspective, *Esthetics in Function* refers to the preservation or enhancement of smile esthetics. It is intrinsically connected to understanding static and dynamic functional principles that act on the patient's stomatognathic system. Therefore, the esthetic harmony and effectiveness of occlusal function are integrated and are in constant movement in the search for balance. It is only from the complete understanding of these varied and complex relationships that the dentist, also a being in continuous evolution, will be able to diagnose and treat the patient with a pragmatic and effective long-term approach.

I tried to make evident the concern in sharing a humanized approach for the broad understanding of the patient that is also practical in applying esthetic, functional, structural, and biologic principles that underlie all treatments. From this point of view, the patient will always be the central focus of attention, and the dentist and their team must do everything to welcome, understand, and treat the patient as comprehensively as possible.

Through these pages, I encourage each professional to develop as complete an understanding of their work system as possible as well as an extensive clinical repertoire that integrates systemic and dental health for the patient's benefit. The dentist must become a complete being – multimedia and ethical – developing broad competencies, such as, for example, emotional intelligence, interpersonal communication skills, management, and leadership principles, in addition to being aware of the constant technologic advances occurring in our profession.

Finally, my purpose with this book is not to teach anything in particular but to stimulate changes in the reader's thoughts, feelings, and attitudes based on shared knowledge, experiences, and failures, helping to solidify a path toward excellence and achievement.

Enjoy reading.

A handwritten signature in black ink that reads "Marcelo Calamita". The signature is fluid and cursive, with a large initial 'M' and a long, sweeping underline.

MARCELO CALAMITA



PREFACE

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C H A P T E R



CLINICAL EXAMINATION

ESTHETIC EXAMINATION

MARCELO A. CALAMITA | FELIPE MIGUEL PINTO SALIBA

At the end of the anamnesis, the dentist should invite the patient to accompany them to the clinical room. After they are seated on the dental chair, explain – briefly – that the objective of the clinical examination is to evaluate the most relevant esthetic, functional, structural, and biologic aspects of the treatment plan [Figure 2-01].

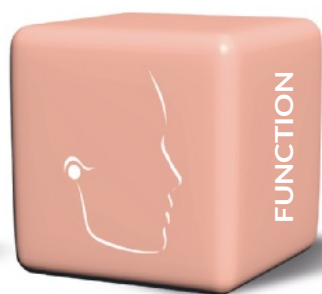
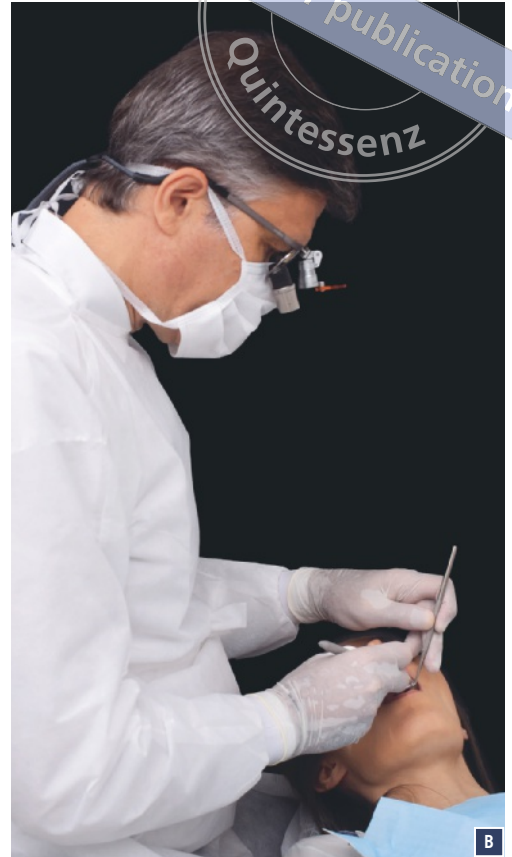
AUTHOR'S NOTE

In addition to obtaining objective data regarding the esthetic aspects, this is also an opportunity to collect subjective information essential to understanding the patient's esthetic perspective. We seek to understand the patient's reactions by making brief comments on some findings. In the case of relevant responses, we should document them in the clinical record to discuss them at an opportune moment.

The clinical examination begins with the extraoral observation of the patient's facial and dentofacial esthetic aspects. The functional examination is carried out extraorally, with the dentist asking for permission to palpate the region of the temporomandibular joints (TMJs) and masticatory muscles (more details of the functional examination are provided later in this chapter). Then, we proceed to the intraoral examination, evaluating the structural and biologic aspects of the teeth and hard and soft tissue [Figure 2-02A,B]. The suggested sequence, performed from extraoral to intraoral, aims to make the patient feel less uncomfortable and gradually to get used to the dentist's physical contact. In addition to collecting all the necessary information for the diagnosis and treatment planning, a comprehensive examination gives the patient a unique perception of the professional's care and distinctiveness. A complete Clinical Examination Form, containing checklists with the data to be examined, will be used to organize the acquired information and enable its analysis for treatment planning [Figure 2-03].



[Figure 2-01] → Sit at the patient's level to explain the sequence of the clinical examination. The intention here is to comfort the patient and demonstrate the professional's concern with each tooth that may be important to the treatment planning of the case.



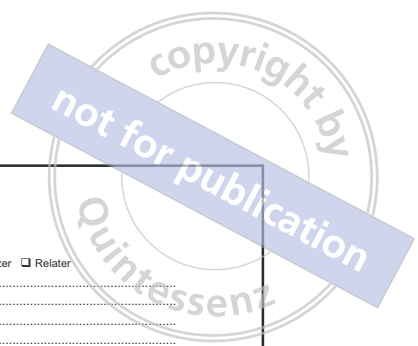
ESTHETIC EXAMINATION

- Face: shape/morphology/profile/symmetry
- Smile line
- Midline
- Maxillary central incisors' edge position
- Maxillary occlusal plane
- Intradental proportion
- Maxillary gingival level
- Interdental proportion
- Mandibular occlusal plane
- Tooth shade/gingival shade

[Figure 2-02A,B] ↑ The sequence of the clinical examination, performed from extraoral to intraoral, allows the patient to feel less uncomfortable with the professional's "gradually invasive" procedure.



← QR code linking to the Clinical Examination Form template that can be customized.



HISTORY (PERSONAL - MEDICAL - DENTAL) / EXPECTATIONS / PERSONALITY Director Thinker Socializer Relater

| ESTHETIC | | FUNCTIONAL | |
|---|--|--|--|
| Face <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Morphology | Profile | Symmetry: Y / N | Mandibular dynamics Opening: mm Lat: mm <input type="checkbox"/> Deflection <input type="checkbox"/> Deviation |
| Smile line | <input type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low | | TMJ evaluation <input type="checkbox"/> Lateral R/L <input type="checkbox"/> Retrodiscal R/L <input type="checkbox"/> Load test R/L |
| Midline | <input type="checkbox"/> Acceptable <input type="checkbox"/> Displaced: mm R/L <input type="checkbox"/> Inclined | | TMJ sounds <input type="checkbox"/> Clicking R/L <input type="checkbox"/> Crepitation R/L <input type="checkbox"/> |
| CI edge position | <input type="checkbox"/> Acceptable <input type="checkbox"/> Change V: mm H: mm | | Muscular evaluation <input type="checkbox"/> Masseter R/L <input type="checkbox"/> Temporalis R/L <input type="checkbox"/> |
| Maxillary occlusal plane | <input type="checkbox"/> Acceptable <input type="checkbox"/> Change | | Bruxism/parafunctional activity <input type="checkbox"/> Grinding <input type="checkbox"/> Clenching <input type="checkbox"/> |
| Intradental proportion | <input type="checkbox"/> Acceptable <input type="checkbox"/> Change | | Interarch relationship <input type="checkbox"/> I <input type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> Crossbite R/L <input type="checkbox"/> Open Ant/Post |
| Maxillary gingival level | <input type="checkbox"/> Acceptable <input type="checkbox"/> Change | | CR/ACP/MIP Premature contact(s)/slide |
| Interdental proportion | <input type="checkbox"/> Acceptable <input type="checkbox"/> Change | | Interferences Teeth (working/non-working) |
| Mandibular occlusal plane | <input type="checkbox"/> Acceptable <input type="checkbox"/> Change | | Functional guidance <input type="checkbox"/> C guidance R/L <input type="checkbox"/> G function R/L <input type="checkbox"/> Absent R/L |
| Tooth shade | Gingival shade | | VDO alteration <input type="checkbox"/> Increase <input type="checkbox"/> Maintain <input type="checkbox"/> Reduce |
| RISK ANALYSIS <input type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High | | | RISK ANALYSIS <input type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High |
| PROGNOSIS <input type="checkbox"/> Favorable <input type="checkbox"/> Fair <input type="checkbox"/> Unfavorable | | | PROGNOSIS <input type="checkbox"/> Favorable <input type="checkbox"/> Fair <input type="checkbox"/> Unfavorable |
| STRUCTURAL | | BIOLOGIC | |
| Carious lesion | | Periodontal disease <input type="checkbox"/> Gingivitis <input type="checkbox"/> Periodontitis <input type="checkbox"/> Peri-implantitis | |
| Questionable restoration | | Periodontal phenotype <input type="checkbox"/> Thick <input type="checkbox"/> Thin <input type="checkbox"/> Intermediate | |
| Defective restoration | | Gingival recession Teeth/probing depth | |
| Fragile remaining tooth structure | | Violation of biologic width Teeth/probing depth | |
| Abrasion | | Tooth hypermobility Teeth/degree | |
| Attrition <input type="checkbox"/> Minimum <input type="checkbox"/> Moderate <input type="checkbox"/> Severe | | Oral hygiene <input type="checkbox"/> Good <input type="checkbox"/> Fair <input type="checkbox"/> Deficient | |
| Biocorrosion <input type="checkbox"/> Minimum <input type="checkbox"/> Moderate <input type="checkbox"/> Severe | | Dentinal hypersensitivity | |
| NCCL <input type="checkbox"/> Minimum <input type="checkbox"/> Moderate <input type="checkbox"/> Severe | | Pulpal/periapical disease | |
| Intraradicular retainer | | Endodontic retreatment | |
| Dental implant | | Semiologic assessment | |
| RISK ANALYSIS <input type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High | | | RISK ANALYSIS <input type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High |
| PROGNOSIS <input type="checkbox"/> Favorable <input type="checkbox"/> Fair <input type="checkbox"/> Unfavorable | | | PROGNOSIS <input type="checkbox"/> Favorable <input type="checkbox"/> Fair <input type="checkbox"/> Unfavorable |

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44 34

45 35

46 36

47 37

48 38

Complementary examinations Photographs Radiographs CT scans Mounted models

Specialized consultation(s)

PRELIMINARY TREATMENT PLAN

| ESTHETIC | | FUNCTIONAL | |
|---|--|--|--|
| Face <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Morphology | Profile | Symmetry: Y / N | Mandibular dynamics Opening: mm Lat: mm <input type="checkbox"/> Deflection <input type="checkbox"/> Deviation |
| Smile line | <input type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low | | TMJ evaluation <input type="checkbox"/> Lateral R/L <input type="checkbox"/> Retrodiscal R/L <input type="checkbox"/> Load test R/L |
| Midline | <input type="checkbox"/> Acceptable <input type="checkbox"/> Displaced: mm R/L <input type="checkbox"/> Inclined | | TMJ sounds <input type="checkbox"/> Clicking R/L <input type="checkbox"/> Crepitation R/L <input type="checkbox"/> |
| CI edge position | <input type="checkbox"/> Acceptable <input type="checkbox"/> Change V: mm H: mm | | Muscular evaluation <input type="checkbox"/> Masseter R/L <input type="checkbox"/> Temporalis R/L <input type="checkbox"/> |
| Maxillary occlusal plane | <input type="checkbox"/> Acceptable <input type="checkbox"/> Change | | Bruxism/parafunctional activity <input type="checkbox"/> Grinding <input type="checkbox"/> Clenching <input type="checkbox"/> |
| Intradental proportion | <input type="checkbox"/> Acceptable <input type="checkbox"/> Change | | Interarch relationship <input type="checkbox"/> I <input type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> Crossbite R/L <input type="checkbox"/> Open Ant/Post |
| Maxillary gingival level | <input type="checkbox"/> Acceptable <input type="checkbox"/> Change | | CR/ACP/MIP Premature contact(s)/slide |
| Interdental proportion | <input type="checkbox"/> Acceptable <input type="checkbox"/> Change | | Interferences Teeth (working/non-working) |
| Mandibular occlusal plane | <input type="checkbox"/> Acceptable <input type="checkbox"/> Change | | Functional guidance <input type="checkbox"/> C guidance R/L <input type="checkbox"/> G function R/L <input type="checkbox"/> Absent R/L |
| Tooth shade | Gingival shade | | VDO alteration <input type="checkbox"/> Increase <input type="checkbox"/> Maintain <input type="checkbox"/> Reduce |
| RISK ANALYSIS <input type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High | | | RISK ANALYSIS <input type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High |
| PROGNOSIS <input type="checkbox"/> Favorable <input type="checkbox"/> Fair <input type="checkbox"/> Unfavorable | | | PROGNOSIS <input type="checkbox"/> Favorable <input type="checkbox"/> Fair <input type="checkbox"/> Unfavorable |
| STRUCTURAL | | BIOLOGIC | |
| Carious lesion | | Periodontal disease <input type="checkbox"/> Gingivitis <input type="checkbox"/> Periodontitis <input type="checkbox"/> Peri-implantitis | |
| Questionable restoration | | Periodontal phenotype <input type="checkbox"/> Thick <input type="checkbox"/> Thin <input type="checkbox"/> Intermediate | |
| Defective restoration | | Gingival recession Teeth/probing depth | |
| Fragile remaining tooth structure | | Violation of biologic width Teeth/probing depth | |
| Abrasion | | Tooth hypermobility Teeth/degree | |
| Attrition <input type="checkbox"/> Minimum <input type="checkbox"/> Moderate <input type="checkbox"/> Severe | | Oral hygiene <input type="checkbox"/> Good <input type="checkbox"/> Fair <input type="checkbox"/> Deficient | |
| Biocorrosion <input type="checkbox"/> Minimum <input type="checkbox"/> Moderate <input type="checkbox"/> Severe | | Dentinal hypersensitivity | |
| NCCL <input type="checkbox"/> Minimum <input type="checkbox"/> Moderate <input type="checkbox"/> Severe | | Pulpal/periapical disease | |
| Intraradicular retainer | | Endodontic retreatment | |
| Dental implant | | Semiologic assessment | |
| RISK ANALYSIS <input type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High | | | RISK ANALYSIS <input type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High |
| PROGNOSIS <input type="checkbox"/> Favorable <input type="checkbox"/> Fair <input type="checkbox"/> Unfavorable | | | PROGNOSIS <input type="checkbox"/> Favorable <input type="checkbox"/> Fair <input type="checkbox"/> Unfavorable |

[Figure 2-03] → The Clinical Examination Form is divided according to the essential aspects to be evaluated in terms of esthetics, function, structure, and biology. The checklist style allows all critical data to be verified and organized for treatment planning.

FACE

Facial evaluation is a fundamental step in any esthetic treatment to identify significant asymmetries or disharmonies that may interfere with treatment planning¹ and analyze the shape of the face to plan a pleasant smile.

To evaluate the frontal and lateral angles, the dentist should assume a position that is at the same height as the patient and in front of their face, in an upright position. If the dentist and the patient are of significantly different heights, both can sit on stools with adjustable heights. The patient should be oriented to look forward toward the horizon, as with the natural head position during daily activities². It is recommended to use frontal [Figure 2-04A-C] and lateral [Figure 2-05A,B] view photographs as well as videos to record the esthetic aspects that can help the diagnosis and treatment planning, to significantly improve communication with the patient, and to help them to understand the identified problems [Figure 2-04A-C].

[Figure 2-04A-C] ↓ The dentofacial esthetic analysis is performed with the patient upright, looking at the horizon. Ideally, the faces of the patient and the dentist should be on the same level. As essential facial photographs for esthetic analysis, we suggest three frontal view photographs - one with the lips at rest, one with a posed smile, and one with a wide smile.



[Figure 2-05A,B] ← Lateral view photographs with the lips at rest and a posed smile are suggested to complement the dentofacial esthetic analysis.

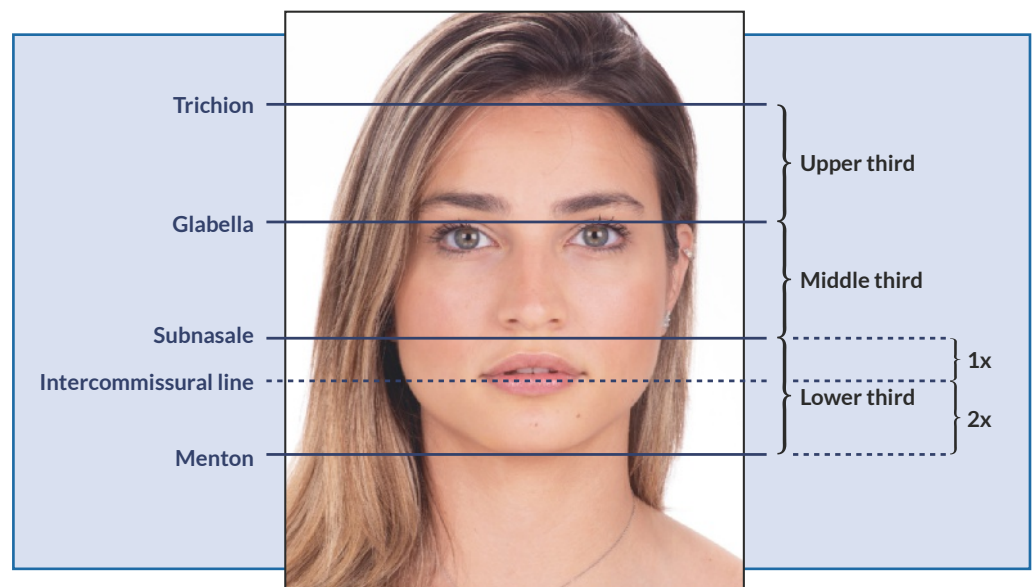
During the esthetic analysis of the patient's face and smile, horizontal and vertical lines should be drawn on the photographs to be used as reference planes for an objective evaluation. In the frontal view, it is suggested to draw horizontal lines through the trichion (hairline), glabella, subnasale point, and menton^{1,3-5}. The interpupillary line and the intercommisural line will also be determined with a dashed line to enable the horizontal alignment of the photograph [Figures 2-06 and 2-07].

After determining the horizontal lines, the face will be divided into three sections, as follows:

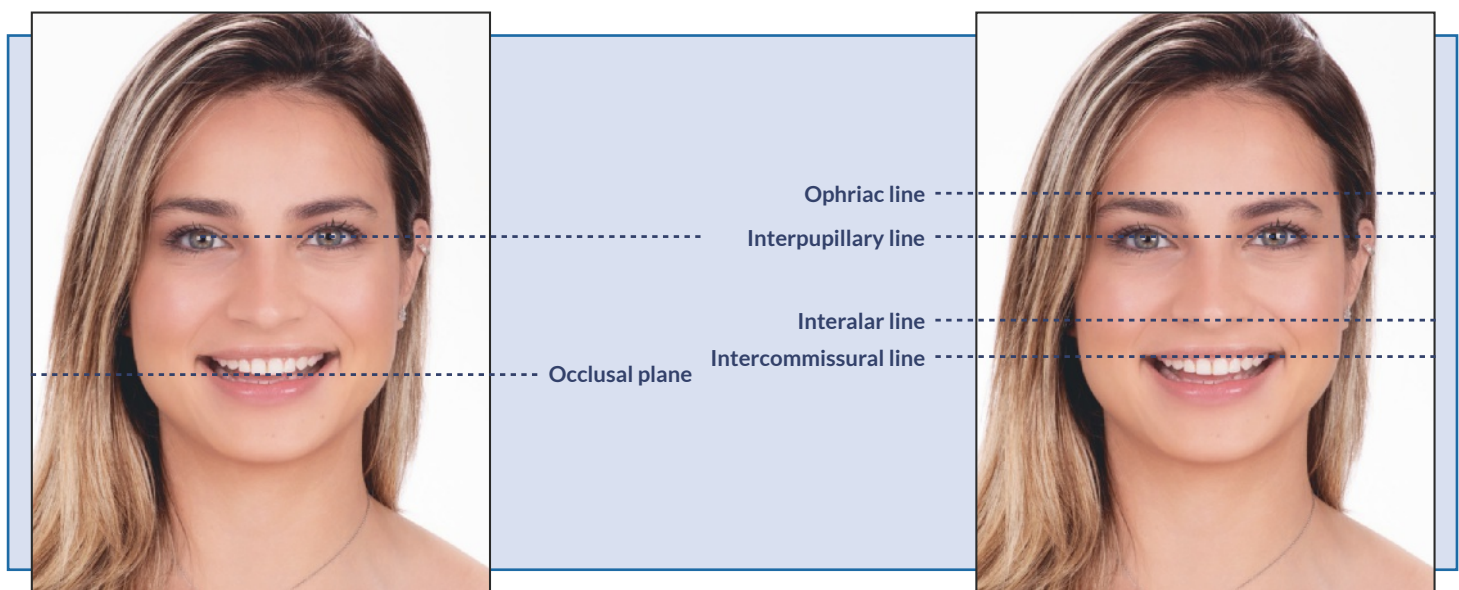
Upper third: distance from trichion to the glabella.

Middle third: distance from the glabella to the subnasale point.

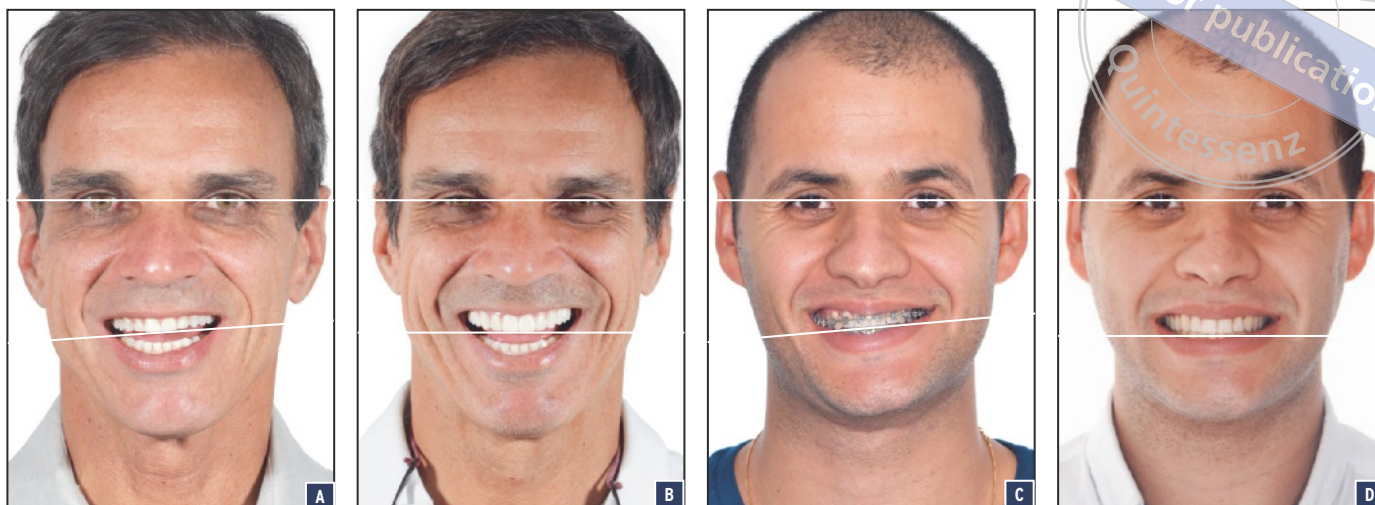
Lower third: distance from the subnasale point to the menton.



[Figure 2-06] → Horizontal lines are determined on the frontal view photograph of the patient's face for facial analysis to verify the harmony between the facial thirds and to identify dentofacial anomalies.



[Figure 2-07] ↑ A critical esthetic parameter to be observed during clinical and photographic evaluation is the parallelism of the interpupillary line with the occlusal plane. When this does not occur, a complete analysis should be carried out to verify whether the discrepancy is the interpupillary line, the occlusal plane, or both. If misalignment exists between these lines, a combination of horizontal reference lines, such as the ophric, interalar, and intercommisural lines, should be used as a parameter. A mock-up or temporary restoration is recommended to confirm the harmony of the planned smile.



The lower third can be subdivided into upper and lower portions. The upper portion extends from the subnasale point to the oral commissure, and the lower portion from the oral commissure to the menton. There is usually a 1:2 ratio between these portions [Figure 2-08A-D].

This facial “sectioning” enables the detection of facial asymmetries. Abnormalities identified in the upper third of the face are often related to craniofacial syndromes. The symmetry of the eyes, nose, cheeks, and ears is generally observed in the middle third of the face. The lower third is the most relevant for the dentist, as it is where changes can be made through orthodontic, orthognathic, restorative, and orofacial harmonization treatments. Vertical or horizontal discrepancies in skeletal development or a reduction in the vertical dimension of occlusion (VDO) can be observed.

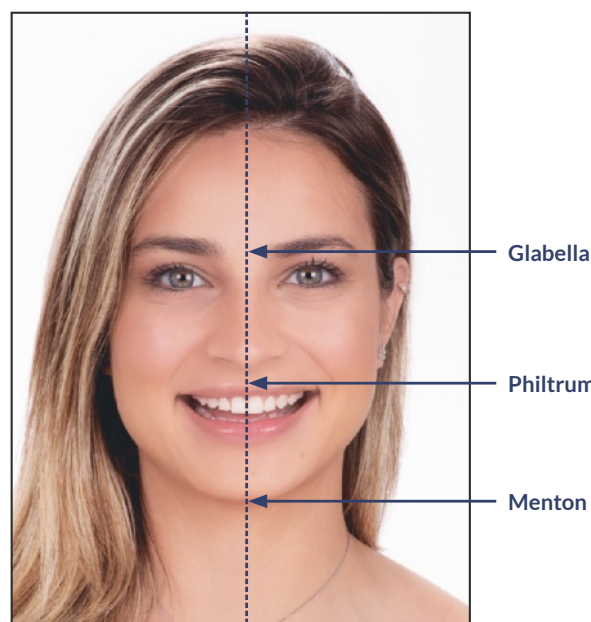
After drawing the horizontal lines, the midline of the face is drawn using the glabella, the philtrum, and the menton as references [Figure 2-09]. The facial midline analysis allows the assessment of horizontal symmetry between the right and left sides of the patient’s face. Horizontal asymmetries were found in 52.4% of individuals¹. Significantly asymmetrical faces may be associated with growth anomalies, developmental anomalies, or pathologies. Such cases should be evaluated with special attention and additional diagnostic tests, if necessary. As a biometric parameter, the facial midline is perpendicular to the interpupillary line in approximately 70% of cases^{6,7}.

[Figure 2-08A-D] ↑ Top

Clinical cases in which there is a lack of parallelism between the interpupillary line, intercommissural line, and occlusal plane. Resolution via restorative treatment [A,B]. Resolution via orthodontic treatment and orthognathic surgery [C,D]. (Case courtesy of Dr. Marcos Pitta.)

[Figure 2-09] ↓ Bottom

Position of the facial midline: the center of the glabella, the philtrum, and the menton are the references.



It is recommended to evaluate the patient's facial morphology⁸ as it can influence treatment planning. Patients can be brachyfacial, dolichofacial, or mesiofacial⁹⁻¹². Brachyfacial individuals generally have a short lower third of the face, a long mandibular ramus, pronounced masseters, and wide dental arches. They may present a deep overbite. In the sagittal view, they present a reduced distance from the nasal base to the menton. Additionally, the base of the mandible is almost parallel to the ground due to a smaller gonial angle¹³ [Figure 2-10A,B].

On the other hand, dolichofacial individuals present an elongated lower third of the face, with a short mandibular ramus, masseters that are not very pronounced, and narrow dental arches. They may present an anterior open bite and inadequate functional guidance [Figure 2-11A,B]. In the



[Figure 2-10A,B] → Top Patient with brachyfacial morphology: lower third of the face with a short appearance, long mandibular ramus, and pronounced masseters are common features in these individuals.



[Figure 2-11A,B] → Bottom Patient with dolichofacial morphology: an elongated lower third of the face, short mandibular ramus, and masseters that are not very pronounced are observed in these individuals.

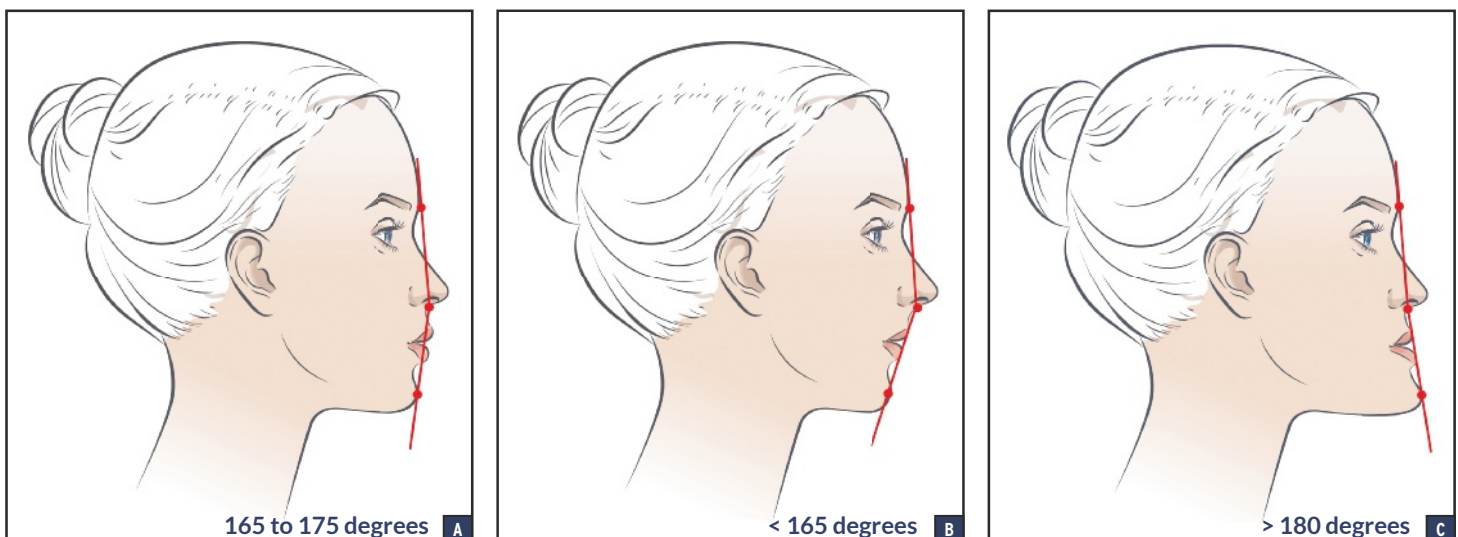
sagittal view, the base of the mandible is inclined due to an obtuse gonial angle. Such patients may require a reduction of the VDO by occlusal adjustment, orthodontics, or orthognathic surgery. Mesiofacial individuals represent an intermediate and balanced pattern of the above characteristics. Radiographic or cephalometric tests can be requested to properly diagnose the facial morphology.

Determining the magnitude, frequency, duration, distribution, and direction of the occlusal forces to which the teeth or restorations will be submitted is fundamental to defining the treatment risks. Clinical studies have shown a correlation between facial morphology and the patient's bite force¹⁴⁻¹⁷. Brachyfacial individuals can present intense bite forces, three to four times higher than dolichofacial individuals¹⁴. The long mandibular ramus and acute gonial angle in brachyfacial individuals suggest a mechanical advantage for the mandibular elevator muscles^{14-16,18}, amplifying the forces that act on the stomatognathic system.

Facial evaluation in the sagittal view is also recommended to analyze the anteroposterior relationship between the maxilla and mandible. In addition, it allows the definition of the patient's profile from the facial contour angle resulting from the intersection of two straight lines: the first from the glabella to the subnasale point, and the second from the subnasale point to the chin (soft tissue pogonion)^{19,20}.

A typical angle between these lines is from 165 to 175 degrees [Figure 2-12A]. Angles less than 165 degrees denote convex facial profiles [Figure 2-12B], and those greater than 180 degrees denote concave facial profiles [Figure 2-12C]. These anteroposterior discrepancies should be confirmed by complementary facial analysis, combined with a thorough cephalometric study and evaluation with an orthodontist or oral surgeon to verify the dental or skeletal factors that need to be addressed.

[Figure 2-12A-C] ↓ Patient profile type determined according to the angle of the facial contour formed by the intersection of two straight lines: the first from the glabella to the subnasale point, and the second from the subnasale point to the chin: normal [A]; convex [B]; concave [C]. A typical angle between these lines is from 165 to 175 degrees. Angles less than 165 degrees denote convex facial profiles, and those greater than 180 degrees denote concave facial profiles [A-C].



AUTHOR'S NOTE

The facial morphology identification described above is helpful for the esthetic and functional clinical diagnosis, but it has limitations. A more detailed analysis should be performed through radiographs, computed tomography (CT), and cephalometric analysis, whenever necessary. When asymmetries are significantly evident, complementary tests and an evaluation with a semiologic specialist are advised.

For example, a patient with significant overjet of the anterior teeth, but with facial proportions and a facial contour angle within the normal range should generally not require orthognathic surgery. On the other hand, angles less than 165 degrees suggest maxillary protrusion or mandibular retrusion, characteristic of Angle Class II patients. This information and the dental issues mentioned may suggest a need for orthognathic surgery [Figure 2-13A-D]. Angles greater than 180 degrees suggest maxillary retrusion or mandibular protrusion, characteristic of Angle Class III patients. These patients may require orthognathic surgery to correct the position of the maxilla, mandible, or both, depending on the treatment plan suggested by the interdisciplinary team [Figure 2-14A-D].

The dentist needs to be aware that the profile facial analysis is part of the complete clinical examination, and the information obtained should be considered along with the patient's wishes and needs as well as the treatment goals. Some changes between the cited reference values will still be compatible with acceptable esthetics and function.



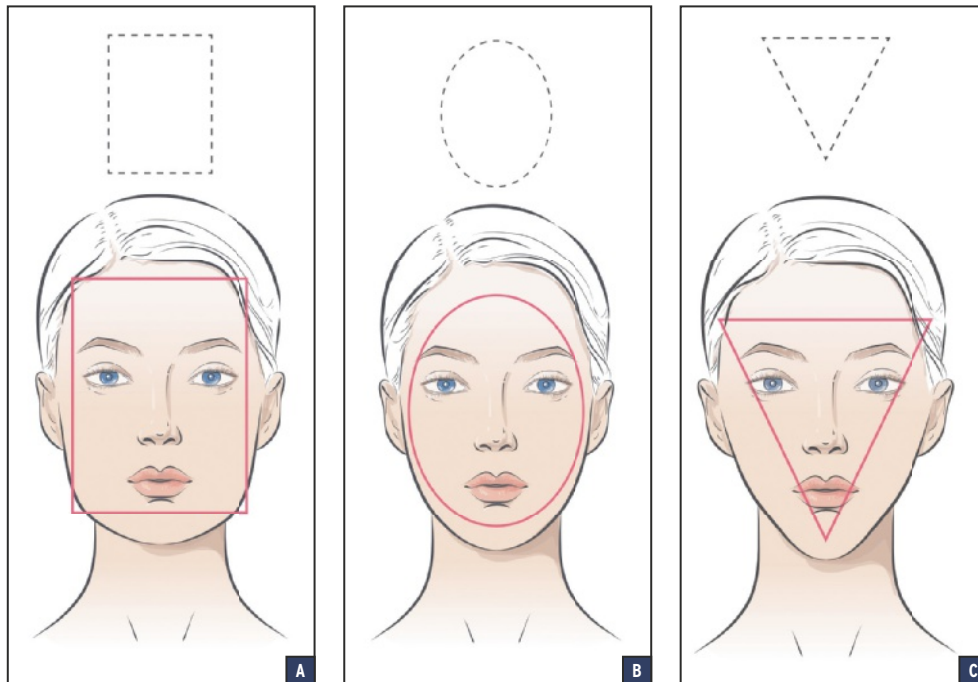
Case courtesy of Dr. Marcos Pitta.

[Figure 2-13A-D] ↑ Patient with a convex profile: the case solution involved orthodontic treatment combined with orthognathic surgery.



Case courtesy of Dr. Marcos Pitta.

[Figure 2-14A-D] ↑ Patient with a concave profile: the case solution involved orthodontic treatment combined with orthognathic surgery.



The facial shape in the frontal view can be classified in a simplified way as rectangular, oval, or triangular [Figure 2-15A-C].

Although the facial shape is not a precise determinant of dental morphology⁵, it constitutes the factors of harmony and the patient's personality, which need to be considered when planning the anatomy and arrangement of the new restorations, as is discussed later in this chapter.

[Figure 2-15A-C] ← The facial shape can be classified in a simplified way as rectangular [A], oval [B], or triangular [C].

SMILE LINE

The position of the lips during smile determines the amount of tooth and gingival exposure. The height of the smile line and its curvature may vary depending on the patient's age and facial anatomy²¹. Lips elongate during craniofacial growth and the aging process. As a general rule, they lower by about 1 centimeter (cm) per decade of life after the age of 40 due to reduced muscle tone and loss of tissue collagen.

According to Tjan et al²², three levels of smile line can be identified: low – when patients do not show more than 75% of the height of the anterior teeth, present in 20.5% of the cases; average – when patients show 75% to 100% of the anterior teeth and interdental papillae, present in 69% of the cases; high – when patients show the full extent of the anterior teeth and a variable range of gingival tissue, present in 10.5% of the cases [Figure 2-16A-C]. According to these authors, a high smile line is twice as common in females compared with males.

[Figure 2-16A-C] ↓ The smile line can be classified as low [A], average [B], or high [C]. The smile line is an important parameter to consider during treatment planning and clinical execution, as minimal imperfections in the restorations or gingival architecture will be visible in cases of average, and – particularly – high smile lines, which may compromise expectations regarding the esthetic outcomes.



Knowledge of the amount of tooth and gums that is exposed during the smile is critical in determining the extent and complexity of treatment. Patients with a high smile line and high esthetic expectations will demand extra attention from the interdisciplinary team, since minimal imperfections in the restorations or the gingival architecture will be visible and may compromise the esthetic results. Dentists should be aware that excessive gingival display in high smile lines can have multiple etiologies aside from lip hypermobility; for example, vertical maxillary excess, short upper lip, supraeruption of the maxillary anterior teeth, and wear due to attrition followed by compensatory dentoalveolar eruption and altered passive eruption. Such diagnostic possibilities should be discussed with the patient, along with the consideration of the biologic costs of additional surgical or esthetic procedures to correct them²³ [Figures 2-17 to 2-23].



[Figure 2-17A-F] ↑ Low smile line: milled metal-ceramic crowns with attachments and a removable partial denture were used.



[Figure 2-18A-C] ↑ Average smile line: crown lengthening surgery was performed, followed by minimally invasive ceramic restorations.



[Figure 2-19A,B] ← Average smile line: replacement of a fixed metal-ceramic prosthesis with a fixed dentogingival metal-ceramic prosthesis.



[Figure 2-20A,B] ← Average smile line: a combination of orthodontic treatment, orthognathic surgery, and ceramic restorations.



[Figure 2-21A,B] ← High smile line: connective tissue graft (CTG) surgery to conceal the grayish appearance of teeth 11 and 21, followed by composite resin restorations on teeth 12 and 22, and ceramic crowns on teeth 11 and 21.



[Figure 2-22A,B] ← High smile line: replacement of ceramic crowns and the manufacture of a fixed dentogingival prosthesis for teeth 24 to 26.



[Figure 2-23A-D] ↑ High smile line: the case solution involved the combination of orthodontic treatment with orthognathic surgery.



[Figure 2-24A,B] ↑ A professional taking photographs and videos of the patient with a smartphone in an uncomplicated manner.

When taking photographs or videos to record the extent of the smile, one should try to keep the patient relaxed, as a spontaneous smile produces a higher smile line and exposure of approximately 30% more of the teeth and gums in the premolar region compared with a posed smile^{24,25} **[Figure 2-24A,B]**.

The shape and thickness of the lips warrant some consideration. The curvature of the upper lip in line with the maxillary gingival levels grants harmony to the smile, in the same way as does the curvature of the lower lip in relation to the maxillary incisal plane. For this reason, a flat lower lip tends not to harmonize with a curved incisal plane in the case of dominant central incisors²⁶. Regarding the thickness of the lips, thick lips tend to harmonize with dominant anterior teeth and thin ones with less dominant anterior teeth⁵.

It is recommended to pay attention to the symmetry of the lip morphology. Since the lips are the frame of the smile²⁷, when they are asymmetric, there is an uneven tooth and gingival exposure, resulting in a “crooked” smile aspect. This aspect should be recorded through photographs and clarified with the patient before any procedure is performed to avoid patient dissatisfaction, since about 22% of individuals have asymmetric lips²⁸ **[Figure 2-25A,B]**.

The measurement of the length of the lips can be helpful in the differential diagnosis of gingival smiles^{29,30}. As a reference, the average lip length at 30 years of age is 20 to 22 millimeters (mm) in females and 22 to 24 mm in males³¹.

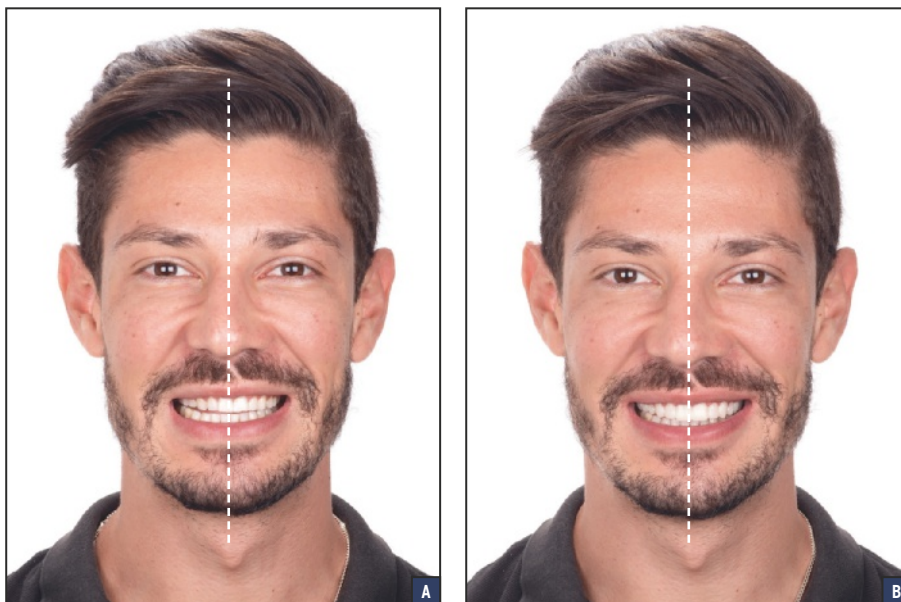
[Figure 2-25A,B] → The shape of the patient’s lip pre- and posttreatment. Asymmetric lip morphology can generate a feeling of an uneven smile and patient dissatisfaction at the end of treatment. This should be clarified with the patient before any procedure because many patients have asymmetric lips.



MIDLINE

Whether the position of the dental midline is acceptable with the facial midline or whether it is displaced laterally should be evaluated. A more precise analysis of this displacement will be carried out during the analysis and treatment planning of the case, and its meaning and relevance should be discussed with the patient at the appropriate moment [Figure 2-26A,B].

In addition to the position of the dental midline, the inclination of this line in relation to the facial midline should be carefully evaluated for its esthetic impact. In order to discuss the feasibility and indication of different treatment approaches, this inclination should be communicated to the interdisciplinary team and the dental laboratory technician (DLT) through photographs, videos, and models (plaster or virtual) mounted on an articulator using a facebow [Figure 2-27A,B].



[Figure 2-26A,B] ← The alignment between the facial midline and the dental midline is one of the critical factors of a harmonious smile. This aspect should be discussed with the patient due to its implications for the type and extent of treatment.



[Figure 2-27A,B] ← The inclination of the dental midline in relation to the face is considered an unpleasant factor for the harmony of the smile. This information should be included in the diagnosis and its correction should be considered in the treatment options.

MAXILLARY CENTRAL INCISORS' EDGE POSITION

The three-dimensional (3D) maxillary central incisors' edge position is the “keystone” or starting point for the esthetic evaluation and restorative treatment plan^{7,32,33}, being closely associated with the facial midline. Its determination is directly linked not only to esthetic aspects but also to functional and phonetic ones, as will be shown later in this chapter and in other chapters.

The maxillary central incisors' edge position is planned by analyzing the exposure of the teeth and lips at rest and during smile, statically through photographs and dynamically through videos. During the examination and recording of the images, the patient is asked to keep the lips slightly apart without the teeth making contact. In order to help the patient in this task, ask them to pronounce the letter “M” and to keep their lips still after pronouncing it. Another way would be to ask them to lightly touch their lips and then open them enough to breathe through their mouth [Figure 2-28].

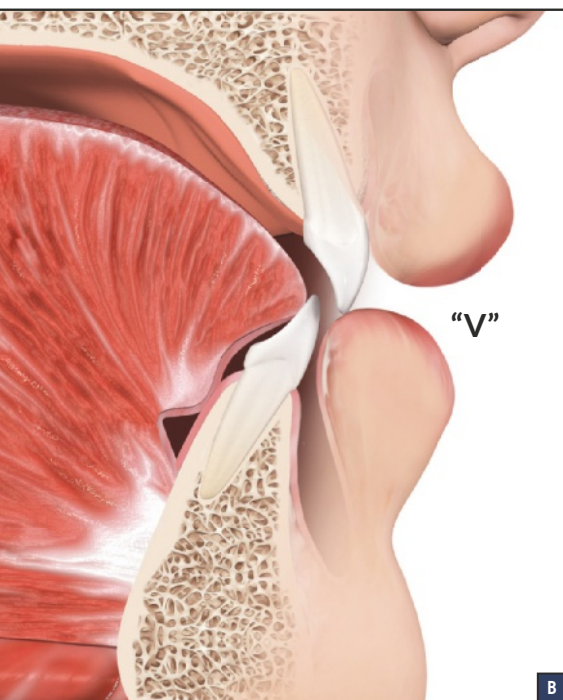
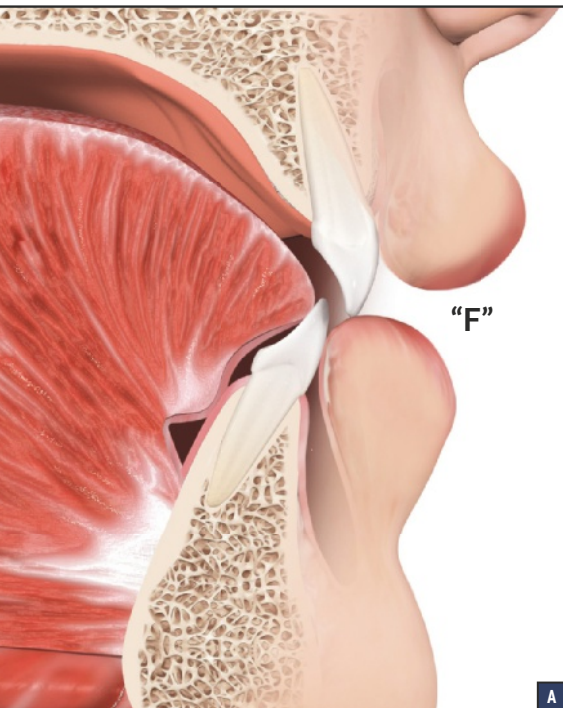


[Figure 2-28] → The maxillary central incisors' edge position is the “keystone” for determining esthetics and integration with masticatory and phonetic function.

As a general rule, the anterior teeth need to be elongated in the incisal direction in cases of insufficient tooth exposure caused by severe tooth wear or maxillary deficiency. Alternatively, they need to be shortened in cases of excessive tooth exposure due to changes in growth or development, anterior supraeruption in Angle Class II patients, or in the case of periodontal problems. Lengthening and shortening of the incisal edges should always consider the patient's occlusal parameters, as discussed in Chapter 3 [Figure 2-29A-D].

[Figure 2-29A-D] ↓ Clinical cases with changes in the position of the incisal edges of the maxillary anterior teeth.





Regarding the sagittal view, the horizontal position of the buccal surface of the maxillary central incisors and the relationship of the incisal edges to the limit between the dry and wet lower lip vermilion should be recorded during the pronunciation of the labiodental sounds “F” and “V”³⁴⁻³⁶ [Figure 2-30A,B]. This record should be taken in the sagittal view and complemented by an additional “12 o’clock” view [Figure 2-31]. Both views will assist in identifying long or proclined incisal edges, which interfere with the lip closure but are limited in terms of identifying short incisal edges.

When evaluating the dentofacial profile, the dentist should determine how a buccal contour change could affect esthetics. Anterior teeth with a buccal inclination should generally not be significantly increased in contour due to the risk of impairing esthetics and interfering with the lower lip closure trajectory. On the other hand, teeth with a lingual inclination may have their buccal contour increased in most clinical situations.

[Figure 2-30A,B] ↑

Determination of the position of the incisal edges with the aid of phonetic tests, with the patient pronouncing the “F” and “V” sounds.

[Figure 2-31] →

A photograph from the “12 o’clock” view helps to plan the dental contour. The position of the maxillary anterior teeth should not interfere with the trajectory of lip closure.

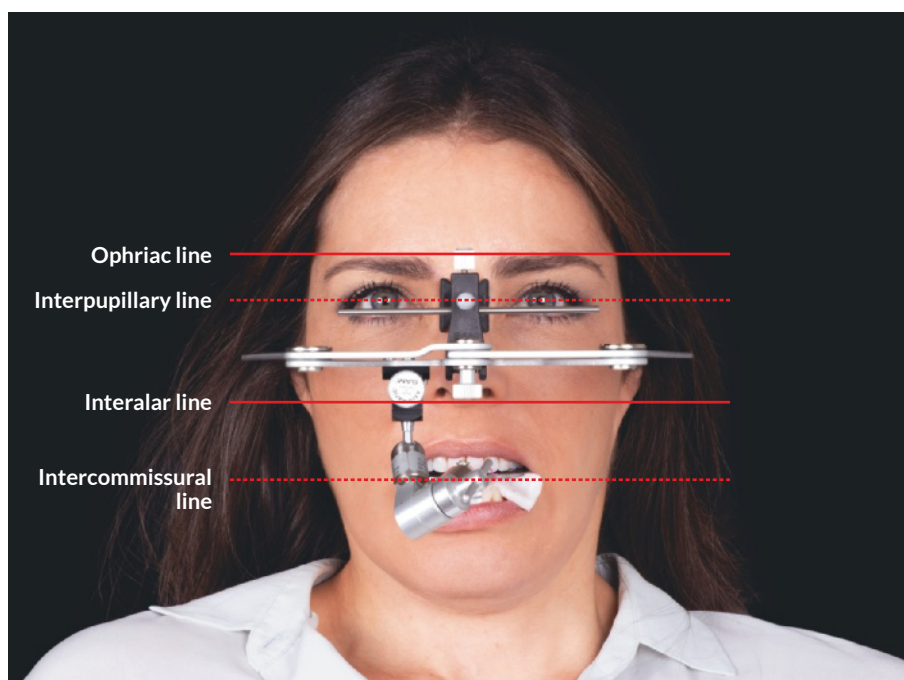


MAXILLARY OCCLUSAL PLANE

The orientation of the maxillary occlusal plane has a critical connection to esthetics and function. Its inadequate assessment is one of the most common errors in complex cases, capable of generating significant esthetic and functional disharmonies. Using a correctly positioned facebow for mounting the models on the articulator is imperative in patients with facial asymmetry patterns or an irregular occlusal plane [Figure 2-32A,B]. According to Margossian et al¹, the interpupillary line was the primary horizontal reference in 88.4% of the situations, followed by the intercommissural line. When the interpupillary line is asymmetric (11.6% of the cases), a combination of horizontal facial reference lines, such as the ophriac (eyebrow line), interpupillary, interalar, and intercommissural lines, is critical to minimizing errors [Figure 2-33].



[Figure 2-32A,B] ← Cases of facial asymmetries can result in treatment planning and execution failures if not diagnosed by the specialist team and the DLT. The assembly of the facebow aligned with a combination of horizontal facial reference lines, such as the ophriac (eyebrow line), interpupillary, interalar, and intercommissural lines, is critical to minimizing errors.



[Figure 2-33] ← Auxiliary horizontal reference lines for facebow assembly.



[Figure 2-34A-C] ↑ The buccal corridor allows the visualization of the natural alignment of the smile by contrasting the buccal surfaces of the teeth with the dark area resulting from the shadows of the cheek: wide **[A]**, moderate **[B]**, and minimal **[C]** buccal corridor.

In the frontal view, the occlusal plane should be correctly oriented with the horizontal reference lines and be perpendicular to the facial midline, following the curvature of the lower lip^{3,4,34,36-42}. In the sagittal plane, the occlusal plane should be oriented in relation to the reference plane used, as detailed in Chapter 8.

The esthetic appearance of the maxillary occlusal plane is related to its horizontal dimensions and how much the teeth fill the buccal corridor; that is, the space between the buccal surfaces of the posterior teeth and the lip commissures³⁸ **[Figure 2-34A-C]**. The buccal corridor allows the visualization of the smile's natural alignment by contrasting the buccal surfaces of the teeth with the dark area resulting from the shadows of the cheek^{43,44}.

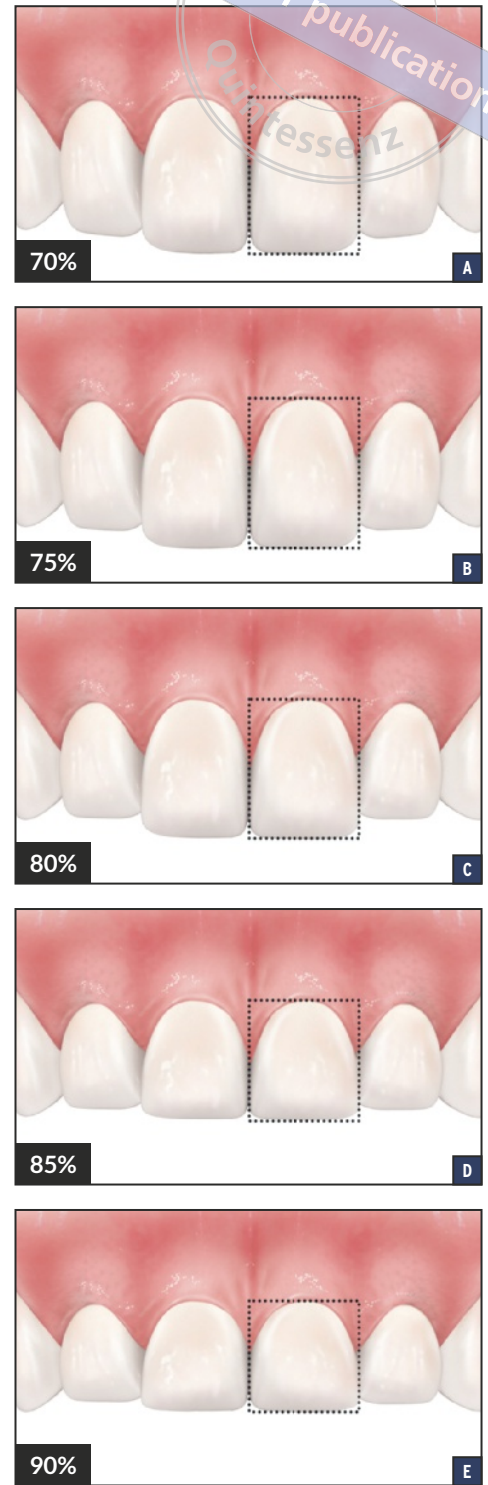
The presence, dimensions, and esthetic influence of the buccal corridor should be observed during the clinical examination and in photographs of the patient's spontaneous smile. Its restorative, orthodontic, or orthodontic-orthognathic treatment should be discussed with the patient due to its biologic complexity. Therefore, a wide buccal corridor should not be the reason for treatment unless the patient's complaints are relevant to this aspect⁴³.

INTRADENTAL PROPORTION

The dental proportion of the maxillary central incisors, defined as the width/height ratio, is a valuable parameter for analysis and esthetic treatment planning⁴⁵. Although ratios for the dental proportion have been shown to be 74% to 89% in the literature⁴⁶, those between 75% to 80% are considered more harmonious^{5,45,47-49}. Dental proportions with a ratio below 70% result in an elongated morphologic appearance, and those above 85% in a wide appearance [Figure 2-35A-E].

The average crown dimension of a maxillary central incisor ranges from 8.3 to 9.3 mm in width and 10.4 to 11.2 mm in height. Incisal wear associated with age, function, or bruxism are factors that can modify this dimension^{46,50}. The maxillary lateral incisors are 2 to 3 mm narrower than the central incisors. The maxillary canines are 1 to 1.5 mm narrower than the central incisors; the maxillary central incisors and canines have similar crown heights, with variations of about 0.5 mm, being 1 to 1.5 mm longer than the lateral incisors⁴⁵.

Another reference is that the maxillary central incisors and canines are, on average, 20% longer than the lateral incisors; the maxillary lateral incisors are 25% narrower than the central incisors, and the maxillary canines are 10% narrower than the central incisors⁵⁰. Several authors have tried to establish relationships between the zygomatic distance, the interpupillary distance, or other facial measurements as a reference to determine the width of the central incisors, but without conclusive results⁵ [Table 2-01].



[Figure 2-35A-E] → An example of dental proportions is the width/height ratio. In general, values between 75% and 80% are considered more harmonious.

| CROWN DIMENSIONS (Maxillary anterior teeth) | CENTRAL INCISOR (CI) | LATERAL INCISOR (LI) | CANINE (C) |
|--|----------------------|---|---|
| Average width | 8.3 – 9.3 mm | 2 – 3 mm narrower than the CI 25% narrower than the CI | 1 – 1.5 mm narrower than the CI 10% narrower than the CI |
| Average height | 10.4 – 11.2 mm | 1 – 1.5 mm shorter than the CI and C 20% shorter than the CI and C | Similar to the CI |

[Table 2-01] ↑ Anatomical references to aid smile planning.

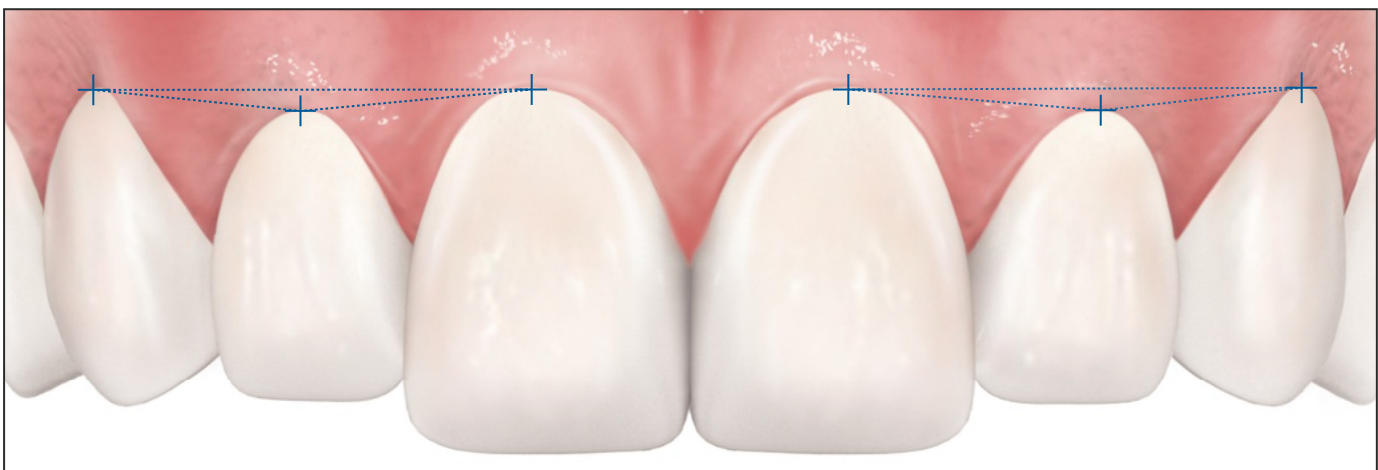
MAXILLARY GINGIVAL LEVEL

For geometric harmony of the maxillary gingival margins, they should be parallel to the curvature of the upper lip. Any lack of continuity or asymmetry in this parallelism will disturb the sense of balance of this composition²⁷ [Figure 2-36].

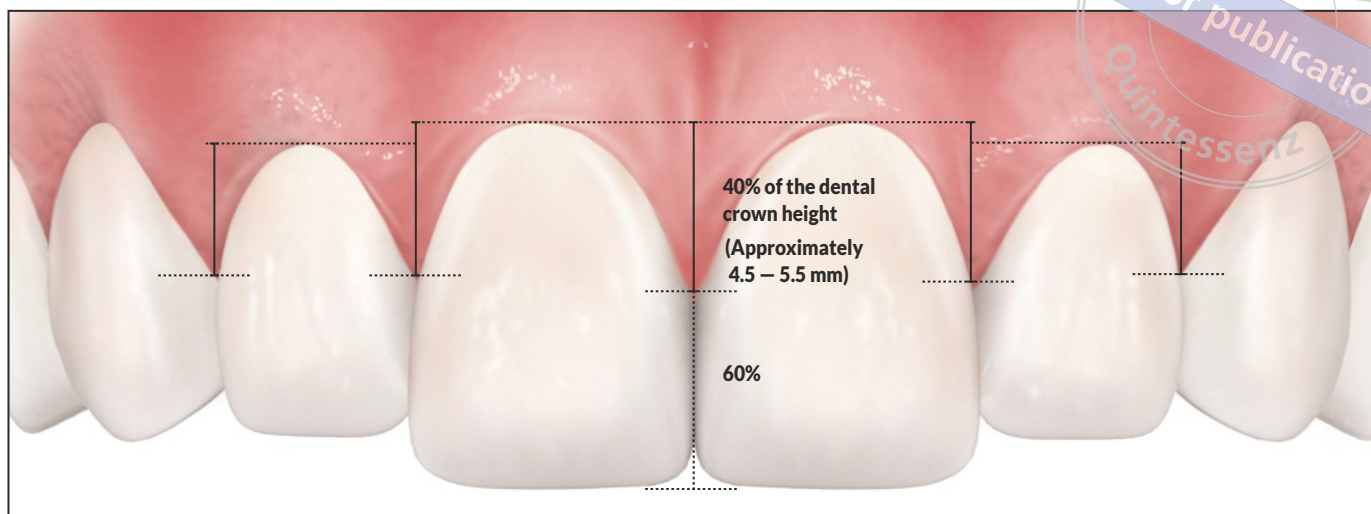
The gingival zenith is the highest point of the gingival margin. Ideally, the central incisors should be symmetric in contour and at gingival zenith height^{3,4}. The central incisors and canines generally have gingival margins that are 0.5 to 1 mm more apical than those of the lateral incisors^{3,4,41,52,53}. The connection of the gingival zeniths of the three teeth in a quadrant forms the gingival triangle, which ideally should be symmetric with the opposite side [Figure 2-37].

The frequency and magnitude of distal zenith displacement are tooth-dependent, generally more significant in the maxillary central incisor than in the lateral incisor, which is more significant than in the canine. In their study, Mattos and Santana⁵⁴ found that the gingival zenith was distally positioned from 0.06 to 0.96 mm in 96% of the maxillary central incisors, 70% of the lateral incisors, and 12% of the canines. These authors concluded that the gingival zenith is not universally displaced distally, as is commonly stated.

[Figure 2-36] ↓ The optimal position of the gingival zenith.



[Figure 2-37] ↑ Harmony of marginal contour and gingival zenith position.



[Figure 2-38] ↑ The proportion of the dental papillae with the height of the dental crown.

The exposure of the interdental papillae should be evaluated, as it is one of the essential esthetic characteristics of the smile. It impacts the treatment plan when the papillae are short or asymmetric. The interdental papillae of the maxillary teeth are visible during the smile in 91% of individuals. Even patients with low gingival margins can present papillae exposure in 87% of cases⁵⁵. According to Hochman et al⁵⁵, the absence of the interdental papillae during smile often represents the difference between a visually pleasing result and an unattractive artificial smile, in which it was deemed necessary to extend the interproximal contact.

As a reference, the ratio between the length of the papilla and the tooth should be around 40% of the dental crown height, measured from the gingival zenith to the incisal edge, or from 4.5 to 5.5 mm, from the gingival zenith to the lowest portion of the papilla^{56,57} **[Figure 2-38]**.

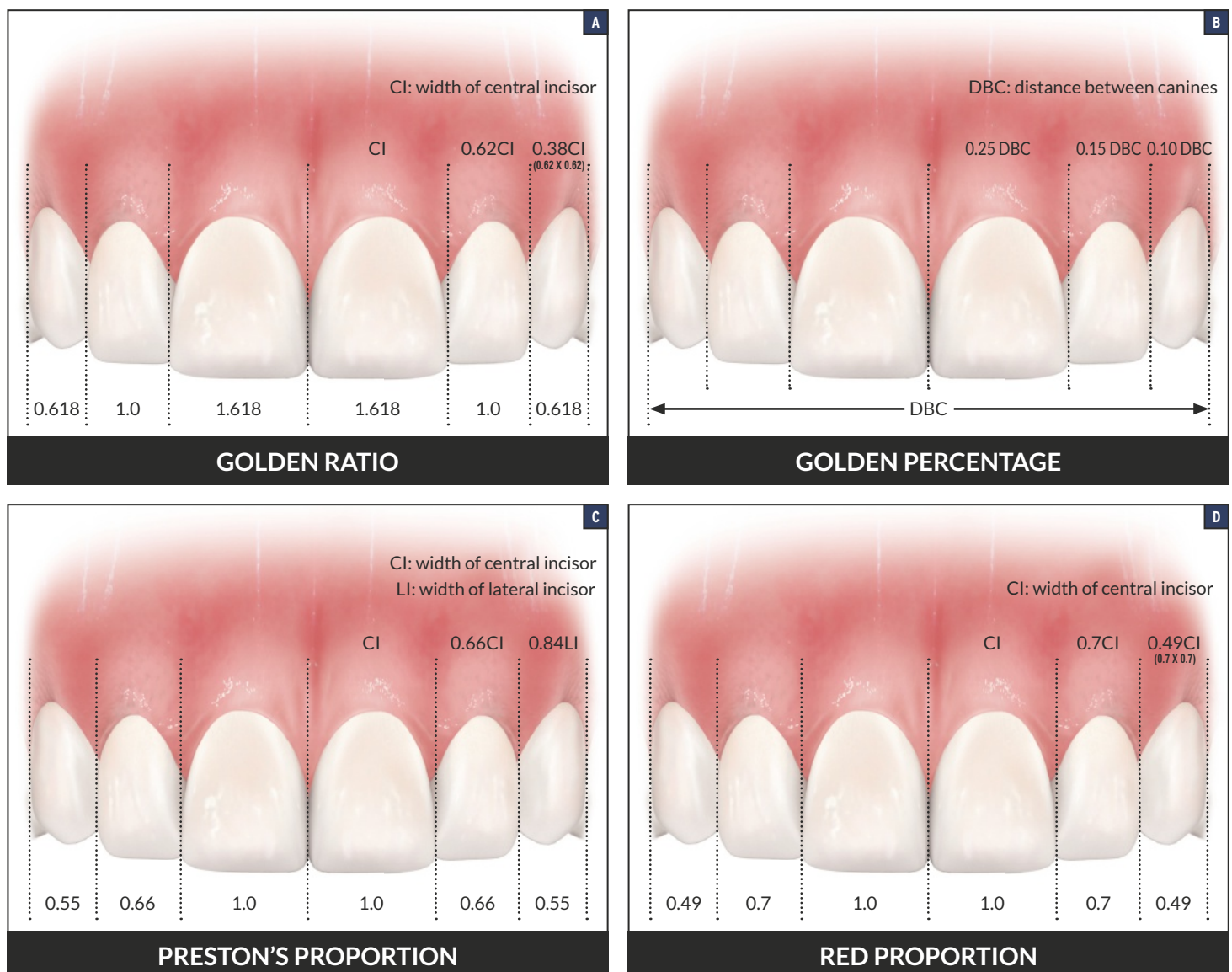
INTERDENTAL PROPORTION

For a very long time there has been a search for mathematic formulas to help in smile composition. Some theories proposed in esthetic treatment planning include the golden ratio^{39,58}, the golden percentage⁵⁹, Preston's proportion⁶⁰, and the recurring esthetic dental (RED) proportion⁶¹⁻⁶³. The golden ratio is a classic concept that is used in several areas of knowledge. In dentistry, it determines that the width of the lateral incisor, in the frontal view, must be 62% of the width of the central incisor, and that the canine, in its mesial aspect, must present 62% of the width of the lateral incisor. Preston⁶⁰ concluded that the golden ratio occurred in only 17% of the cases and generated very dominant central incisors, producing a narrowing of the dental arch. In his work, he suggested a ratio of 66% of lateral incisors to central incisors, and 85% of canines to lateral incisors.

Snow⁵⁹ suggested that a “golden percentage” to establish harmony between the anterior teeth would be more appropriate. Thus, the central incisor of a quadrant would occupy 25% of the smile width on that side, the lateral incisor 15%, and the canine 10%. Ward^{61,63} stated that a ratio of 70% between the central and lateral incisors and between the lateral incisors and canines would be more harmonious than the golden ratio.

Rosenstiel et al⁶² stated that this interdental proportion should also consider the tooth height, with 70% being favorable for teeth with average height (defined as 78% of the width/height ratio), 62% for long teeth, and 80% for short teeth. According to Ahmad⁵³, the most crucial factor in creating a harmonious esthetic result would be a reproducible and constant proportion inherent to the patient, instead of trying to adapt a predefined proportion [Figure 2-39A–D].

[Figure 2-39A–D] ↓
Comparison between the different theories to quantify the interdental proportion: golden ratio **[A]**; golden percentage **[B]**; Preston's proportion **[C]**; recurring esthetic dental (RED) proportion **[D]**.



Interdental proportions are dependent on ethnicity, gender, and personal preference, and their perception is also influenced by color, reflective angles, and interincisal angles^{41,64}. These proportions should not be considered absolute geometric laws, since there is significant individual variation as well as different proportions even in the various quadrants of the same individual. This author only uses the RED proportion as an initial parameter for determining the interdental proportions for treatment planning⁶⁶.

MANDIBULAR OCCLUSAL PLANE

Clinical evaluation of the mandibular occlusal plane should be subdivided into the anterior and posterior teeth. The mandibular anterior teeth should be evaluated for their exposure and position. Limited information is available in the literature regarding these teeth, perhaps because it is wrongly assumed that they have little influence on esthetics. Nassif⁶⁷ demonstrated that individuals expose the mandibular anterior teeth more clearly than the maxillary anterior teeth during phonation. In their study, these authors showed that while 29% of subjects exhibited only the mandibular anterior teeth, 43% exhibited more mandibular anterior teeth than maxillary anterior teeth while speaking.

It is also necessary to assess whether the mandibular anterior teeth are leveled and aligned with the maxillary occlusal plane. As discussed in Chapter 3, this position will influence esthetics, function, and phonetics.

The dental proportion for the mandibular anterior teeth is 60% to 70% of the width/height ratio⁶⁸. Gingival margins and interdental papillae should be evaluated for alignment and symmetry, even though they are less relevant from an esthetic point of view when compared with the maxillary teeth [Figure 2-40].

[Figure 2-40] ↓ Morphologic characteristics of the maxillary anterior teeth.





TOOTH/GINGIVAL SHADE

The initial chromatic appearance of the teeth to be treated and adjacent or antagonist teeth that can serve as a reference should be recorded through photographs with adequate lighting and white balance. Determining the four closest shades from the shade guide and placing their aligned incisal edges with the incisal edges of the natural teeth is an effective form of documentation, according to this author's experience [Figure 2-41A-C]. The use of polarizing filters provides additional visual information that is very useful to the dentist and DLT for layering restorative materials [Figure 2-42A-F] to optimize esthetic results [Figure 2-43A-D].

Suppose there is a need for a prosthetic restoration, such as complete dentures, removable dentures, or fixed dentogingival dentures, that involves reproducing the shade and texture of the gingival tissue. In that case, this shade should also be photographed with the appropriate gingival shade guide [Figure 2-44A-D].

[Figure 2-41A-C] ↑ The shade match should be performed in the first appointment through the use of photographs. The “raw” photo [A] can be manipulated into black and white in order to measure the value [B] or have its brightness reduced and contrast increased in order to observe the chromatic details of the tooth structure [C].



[Figure 2-42A-F] ↑ Polarizing filters have the potential to add useful visual information to assist the dentist and DLT in layering restorations.



[Figure 2-43A-D] ↑ A clinical case involving single-unit restorations and a fixed dentogingival prosthesis on dental implants with ceramic gingiva complemented by composite resin.



[Figure 2-44A-D] ↑ Clinical case of a fixed dentogingival prosthesis over dental implants with ceramic gingiva.

