



Smile Makeover

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<i>Abstract</i>	
CC License CC-BY-NC-SA 4.0	Smile makeover is a comprehensive approach in cosmetic dentistry that involves the harmonious integration of artistic principles and scientific techniques to enhance and transform smiles. This process goes beyond mere aesthetic improvements, influencing individuals' overall well-being and confidence. Experienced cosmetic dentists utilize established smile design principles to assess and rejuvenate smiles, addressing issues such as wear, damage, and aging. The artistry involved in smile designing, when combined with modern dental materials and expert training, ensures the creation of durable, radiant, and healthy smiles that authentically represent the individual's identity.

Introduction

Pierre Fauchard (1678-1761), a French pioneer in dentistry, along with his contemporaries, revolutionized and promoted dental practices while advocating for esthetic considerations. Achieving excellence in dentistry requires a systematic approach encompassing diagnosis, communication, treatment planning, and implementation. Incorporating protocols and checklists for quality control and information management ensures effective and accurate performance of critical tasks.³¹

For consistent and predictable outcomes, practitioners must outline the restorative treatment design early on, with data guiding subsequent rehabilitation phases. Digital Smile Design (DSD) emerges as a versatile digital tool with clinical advantages, enhancing esthetic diagnostic capabilities, facilitating communication among team members, creating a predictable treatment system, improving patient education, motivation, and case presentation effectiveness. Implementing DSD streamlines diagnosis, treatment planning, making the treatment sequence logical, straightforward, and cost-effective.

Despite smile design traditionally being viewed as a subjective art, there's a growing need for objective standards. Various factors contribute to a beautiful smile, including the absence of gaps or missing teeth, relatively aligned teeth, and whiteness within the esthetic zone. Beyond these basics, parameters like smile line, midline, axial inclinations, proportions, emergence profile, tooth anatomy, and gingival architecture are critical. Public demand for esthetic dentistry, particularly tooth whitening, underscores the significant role tooth colour plays in smile attractiveness.¹

PRINCIPLES OF SMILE DESIGNING

The objective of an esthetic makeover is to establish a well-balanced and stable masticatory system, ensuring that the teeth, tissues, muscles, skeletal structures, and joints work together harmoniously. In planning treatments for esthetic cases, it is crucial to recognize that smile design should not be approached in isolation; instead, it should be an integral part of a comprehensive patient care strategy. To attain a successful outcome

that encompasses both health and functionality, it is essential to comprehend the interconnectedness among all the supportive oral structures, encompassing muscles, bones, joints, gingival tissues, and occlusion.²

Components Of An Esthetic Smile

Creating a harmonious esthetic smile involves seamlessly blending facial and dental components. Facial composition encompasses diverse face tissues, while dental composition focuses on teeth and their relationship with gingival tissues. Evaluation of both aspects is crucial in smile design.

Facial beauty adheres to esthetic principles like alignment, symmetry, and proportion. Treatment planning may involve various disciplines for optimal dental and facial aesthetics. In cases without significant facial discrepancies, a smile makeover may focus on dental composition.³²

Key facial features, the interpupillary line and lips, play a crucial role. The interpupillary line should be perpendicular to the face's midline and parallel to the occlusal plane. Lips define smile boundaries, and correcting discrepancies may require addressing facial composition.

Ideal face dimensions are classically defined, influencing tooth size, shape, and lateral profile. Face width should equal five "eyes," and the distance from eyebrow to chin should match. Vertical dimensions are divided into thirds. Facial morphology influences tooth features, and the lateral profile can be straight, convex, or concave.³

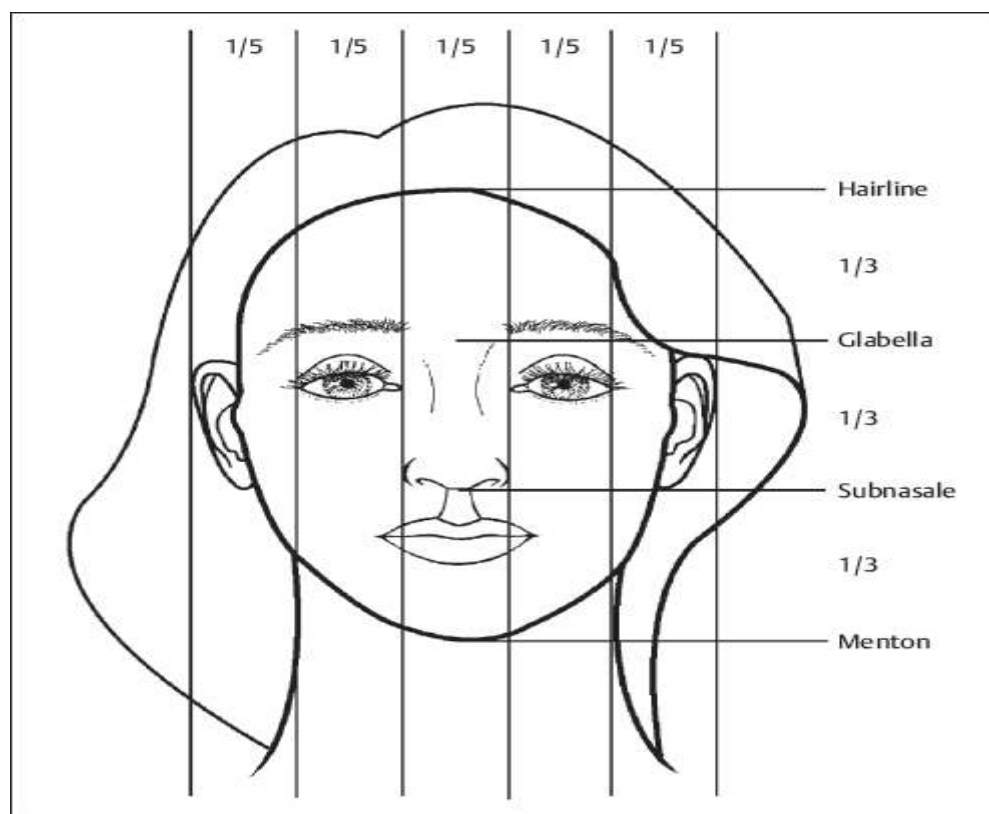


Figure 1: Horizontal and vertical dimensions of face

Vital elements of smile designing (dental composition)

The vital elements of smile designing include the following:

1. Tooth components
 - a. Dental midline
 - b. Incisal lengths
 - c. Tooth dimensions
 - d. Zenith points
 - e. Axial inclinations
 - f. Interdental contact area (ICA) and point (ICP)
 - g. Incisal embrasure
 - h. Sex, personality and age.
2. Symmetry and balance

3. Soft tissue components
 - a. Gingival health
 - b. Gingival levels and harmony
 - c. Interdental embrasure
 - d. Smile line

The role of each of the above-mentioned factors in smile designing is given below.

Tooth Components Of Smile Designing

Smile designing involves several crucial factors, including dental midline, incisal lengths, tooth dimensions, zenith points, axial inclinations, interdental contact area and point, incisal embrasure, and considerations of sex, age, and personality.³³

1. Dental Midline: The vertical alignment of maxillary centrals should be perpendicular to the incisal plane and parallel to the face midline. Anatomical landmarks like the philtrum help assess midline placement.
2. Incisal Lengths: Critical for smile creation, the maxillary incisal edge position sets the reference for tooth proportion and gingival levels. Factors such as tooth display, phonetics, and patient preferences guide the proper incisal edge placement.⁴
3. Tooth Dimensions: Proper dental proportion based on facial morphology is vital for aesthetic smiles. Guidelines like the Golden Proportion and Chu's Esthetic Gauges help establish pleasing tooth dimensions.

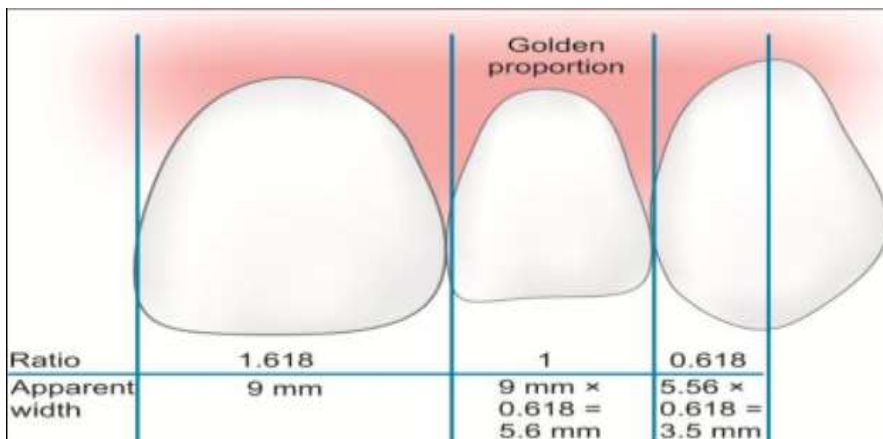


FIGURE 2. Golden proportion based on apparent width from the frontal view

4. Zenith Points: The apical position of the cervical tooth margin, influencing gingival scalloping. Precise zenith point placement is crucial for altering tooth dimensions and angulation.



FIGURE 3. Zenith points and its relation to midline.

5. Axial Inclinations: Vertical alignment of maxillary teeth visible in the smile. Centrals show minimal inclination, while laterals and canines have more pronounced inclinations.

6. Interdental Contact Area and Point: The zone where adjacent teeth touch and the most incisal aspect of the contact area. The Incisal Contact Point moves apically from central to canine.

7. Incisal Embrasures: Natural, progressive increase in size and depth from central to canine. Inadequate depth can make teeth appear overly uniform.

8. Sex, Age, and Personality: Minor variations in tooth characteristics allow for smile characterization based on age, sex, and personality. Youthful teeth have unworn incisal edges, male teeth are more cuboidal, and female teeth are round and delicate. Personality traits influence canine cusp form.⁵

Symmetry And Balance

Symmetry, crucial for centrals, becomes less absolute moving away from the midline. Static symmetry mirrors maxillary centrals, while dynamic symmetry allows for a unique, natural smile. Balance extends from the midline for overall symmetry.³⁴

Soft Tissue Component:

- Gingival Health: Essential for framing teeth, healthy gingiva is pale pink, stippled, firm, and positioned appropriately.

- Gingival Levels: Symmetrical levels for centrals and canines, laterals exhibit a rise and fall for ideal design.

- Gingival Shape: Mandibular incisors and maxillary laterals have a symmetrical half-oval or half-circular shape; centrals and canines exhibit a more elliptical shape.

- Gingival Zenith: Located distal to the long axis of centrals and canines; coincides with the long axis of lateral incisors.

- Interdental Embrasure: Should not reveal oral cavity darkness; proper restoration placement prevents black triangles.

- Smile Line: Follows incisal edges, mimicking the curvature of the lower lip; centrals should not appear shorter than canines along the incisal plane.

- Lip Line: Position of the upper lip during smiling; ideal when congruent with gingival margin or displaying 1-2 mm of gingival tissue.^{6,39}

ESTHETIC DIAGNOSIS AND TREATMENT PLANNING

What Is AACD Accreditation?

In 1934, visionaries established the American Academy of Cosmetic Dentistry (AACD) to advance education in dental materials and cosmetic dentistry. Swiftly, the AACD introduced a credentialing system called "Accreditation" to uphold excellence. Over time, as cosmetic dentistry evolved, the Accreditation exam maintained its role as a benchmark for quality. Attaining AACD accreditation demands commitment to ongoing education, rigorous adherence to protocols, and a determination to deliver outstanding dental work. This guide outlines the criteria for achieving Accreditation.^{7,35}

A Guide To Accreditation Criteria

Global Esthetics

- Smile Line
- Incisal Edge Position
- Incisal Plane
- Midline
- Buccal Corridor

Macro Esthetics

- Embrasures
- Principles of Proportion & Central Dominance
- Labial Anatomy, Line Angles & Incisal Edge
- Emergence Profile

- Symmetry
- Axial Inclination

Micro Esthetics

- Shade Selection
- Margin Placement & Design
- Surface Finish, Luster & Reflectivity

- Incisal Translucency & Surface Colour Characterizations
 - Pink Esthetics
- Periodontal Health
- Ovate Pontic
- Gingival Contour, Shape & Position
 - Global Esthetics -
 - Smile Line: Imaginary line along maxillary anterior teeth, mirroring lower lip's curve during smiling.
 - Incisal Edge Position: Key for a natural smile, influenced by incisal display, phonetics, and occlusal plane relation.
 - Incisal Plane: Represents mean curvature, touching incisal edges. Proper alignment crucial for aesthetic appeal.
 - Sound Interaction: Incisal edges should lightly touch vermilion border during certain sounds (e.g., F and V).
 - Midline: Vertical contact between maxillary centrals; perpendicular to incisal plane, parallel to face midline. Minor discrepancies are acceptable, but a canted midline is noticeable. Evaluation considers location, alignment, and relation to facial axis and papilla.
 - Buccal Corridor: Dark space in smile between mouth corners and maxillary teeth. Influenced by smile width, arch width, muscle tone, upper premolar position, canine prominence, and value differences. Ideal U-shaped arch conforms to golden proportion, preventing centrals from dominating. Preservation of a hint of negative space adds depth to the smile.⁸

Macro esthetics in smile design refers to the overall appearance and visual harmony of the smile. It involves the assessment and manipulation of various elements to create a balanced and aesthetically pleasing smile.

- Incisal Embrasures: Triangular spaces between incisal edges of adjacent teeth; gradually increase in size from central to canine. Adequate development ensures a natural appearance, preventing uniformity or box-like appearance. Excessive depth can lead to unnatural pointed teeth.
- Cervical Embrasures: Spaces between gingiva and contact area of adjacent teeth. Darkness should not be visible. Proper development avoids black triangles by ensuring the restoration's most apical point is 5 mm or less from the crest of the bone. Overextended restorations can cause improper emergence profile and inflamed gingival tissues.⁹
- Central Dominance: Central incisors should be the dominant teeth, displaying pleasing proportions.
- Width-to-Length Ratio: Centrals' width-to-length ratio should be around 4:5 (0.8 to 1.0).

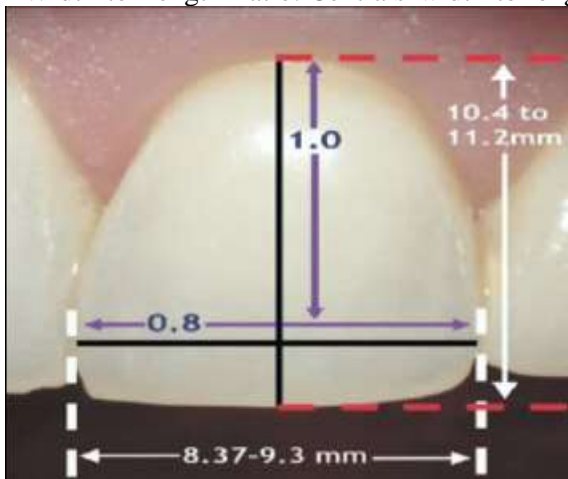


FIGURE 4. Width and length of the centrals.

- Golden Proportion: Ideal mathematical ratio among centrals, laterals, and canines when viewed from the front.

Labial Anatomy and Contour: Labial anatomy should mimic the morphology of the natural dentition. The presence of lobes is crucial as it allows a more natural and varied pattern of reflected light. The proper placement of lobes can influence the perception of tooth width. Labial contour should exhibit three planes (gingival, middle, and incisal) and should be evaluated from the lateral view. Over contouring the incisal one-third can lead to a flat and unnatural profile of the incisors.^{10,36}

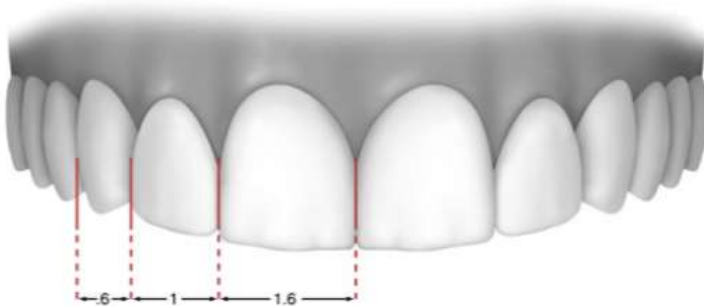


FIGURE 5. Proportion of the width of centrals.

- Emergence Profile: Silhouette of the tooth at its gingival one-third; prevents inflammation and dark spaces in cervical embrasure.
- Symmetry: Crucial for central incisors; less critical away from midline; impacted by gingival levels and incisal plane.
- Axial Inclination: Vertical alignment of maxillary teeth; natural, progressive increase from central to canine.

Micro esthetics in smile design focuses on the finer details and characteristics of individual teeth to create a natural and aesthetically pleasing appearance. It involves considerations such as shade selection, margin placement, surface finish, and incisal translucency.

- Shade Selection: Critical for micro esthetics; customized colour, hue, chroma, and value; richer chroma in gingival third; variations for pleasing results.³⁸
- Margin Placement & Design: Crucial for gingival health and aesthetics; ideally at gingival crest height or $\leq 0.5\text{mm}$ apical; avoids inflammation and recession.
- Surface Finish, Luster & Reflectivity: Should mimic natural dentition; proper polish and texture essential for a natural appearance.
- Incisal Translucency & Colour Characterizations: Vital for micro esthetics; use shades or tints for polychromatic appearance; richer chroma in gingival third; halo effect at incisal edge for contrast.¹¹

Pink esthetics, a crucial facet of smile design, centers around the health and visual appeal of gingival tissues encircling the teeth. The ideal gingiva exhibits a pink hue, stippling, firmness, and a matte surface to signify optimal periodontal health. Key to this aesthetic is the proper development of papillae, ensuring they are pointed and adeptly fill gingival embrasures to prevent undesirable open cervical embrasures and black triangles. Ovate pontics in fixed partial dentures further contribute to the esthetic by emulating the natural emergence of a tooth from the surrounding gingiva.

Gingival contour, encompassing shape and position, significantly influences smile design. Achieving symmetry in the cervical gingival height of centrals, matching that of canines, contributes to a balanced appearance. Positioning the gingival contour over laterals slightly towards the incisal, compared to centrals and canines, enhances the naturalness and esthetic appeal of the smile. The gingival shape, whether half-oval or half-circular for laterals and mandibular incisors, and elliptical for maxillary centrals and canines, along with the gingival zenith's distal location, further contribute to a visually pleasing three-dimensional topography.^{27,28}

A thorough evaluation of gingival contour, shape, and zenith at a 90-degree angle to the facial tooth surface is essential to understanding the intricate relationships among these elements. This approach ensures a comprehensive consideration of gingival topography, vital for achieving a harmonious and aesthetically pleasing smile.¹²

ROLE OF TECHNOLOGY IN CHANGING SMILE

Smile analysis and design are now integral to orthodontic diagnosis and treatment planning, leveraging recent technological advancements to measure dynamic lip-tooth relationships. Digital videography plays a crucial role in both smile analysis and enhancing doctor/patient communication. The multifactorial nature of smile design requires a comprehensive approach, considering soft tissue treatment limitations and aligning orthodontic or multidisciplinary strategies with the patient's and orthodontist's esthetic objectives. Success in smile design hinges on understanding these factors, ensuring a tailored approach to achieve optimal clinical outcomes.¹³

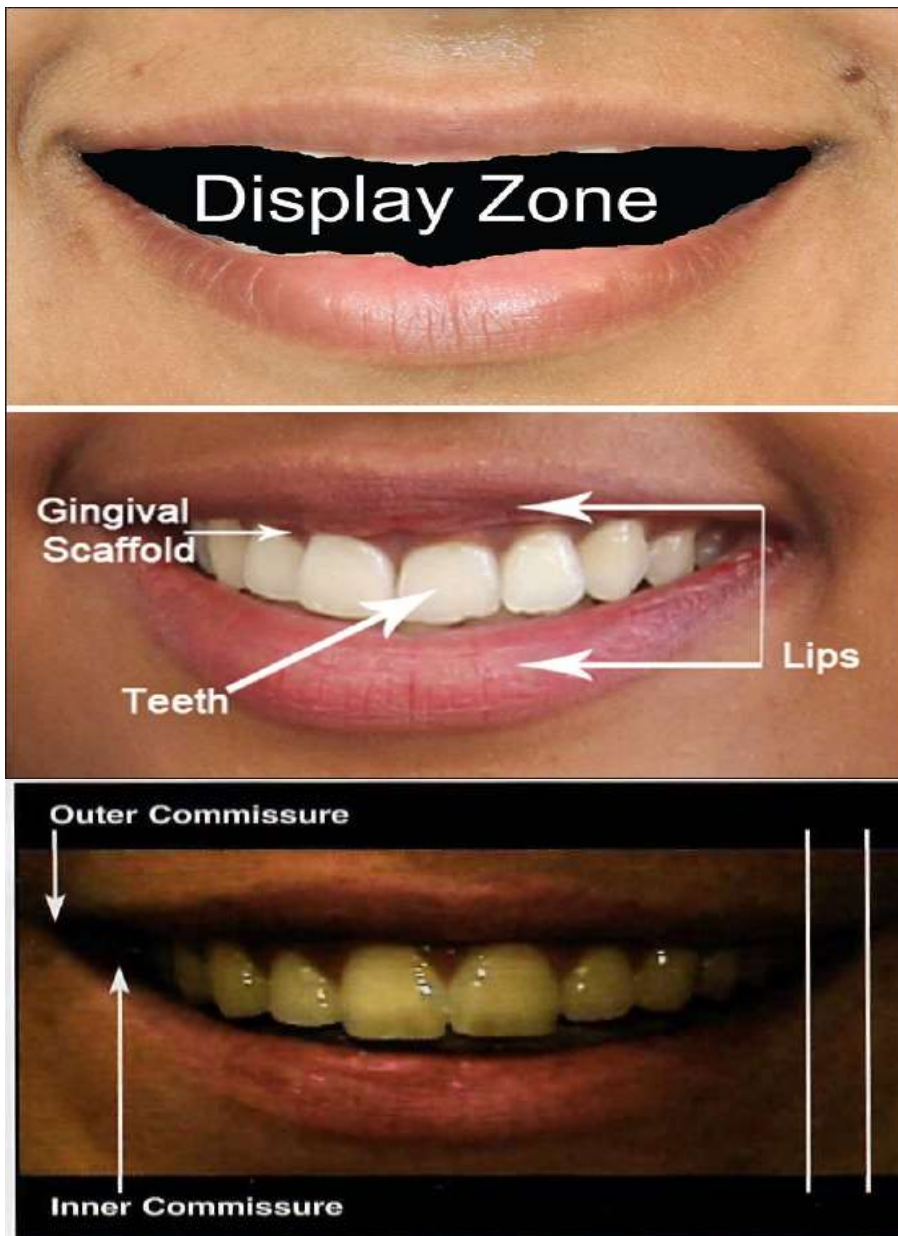


FIGURE 6. Smile components

Smile Classification

There are two main types of smiles: the social smile, used for greetings, and the enjoyment smile, associated with laughter or great pleasure. The social smile is voluntary, involving moderate lip elevator muscle contraction, displaying teeth and sometimes gingival scaffold. The enjoyment smile, involuntary and resulting from maximal lip muscle contraction, exhibits full lip expansion, maximum anterior tooth display, and gingival show.²⁶

Smile style, a determinant of the dynamic display zone, includes three styles: cuspid, complex, and Mona Lisa smiles. The cuspid smile involves elevation of the upper lip, exposing teeth and gingiva. The complex smile entails simultaneous action of upper lip elevators and lower lip depressors, raising the upper lip and lowering the lower lip. The Mona Lisa smile is characterized by the zygomatic major muscles, drawing commissures outward and upward, followed by gradual upper lip elevation. Patients with complex smiles typically show more teeth and gingiva compared to those with Mona Lisa smiles.¹⁴

Smile Analysis

Smile analysis is a comprehensive evaluation of a patient's smile, examining esthetic and functional aspects. Capturing a patient's social smile through video or photos aids in assessing lip function and tongue posture

during speech. Specialized software like SmileMesh analyzes the smile image, measuring 15 attributes such as maxillary incisor display, upper lip drape, buccal corridor ratio, and intercommissure width.

Unlike static records, this dynamic approach offers a precise understanding of incisor position and smile dynamics. The diagnostic phase involves creating a problem list, considering extraoral and intraoral records, lateral cephalogram, radiographs, and plaster study casts. Attributes like dental asymmetry, occlusal plane cant, skeletal relationships, tooth-size discrepancies, and static occlusal relationships are assessed in reverse order to conventional orthodontic methods.

The orthodontic problem list includes descriptive terms for smile-related issues such as inadequate maxillary incisor display, unfavorable Morley ratio, gummy smile, and asymmetric cant. Attributes are ranked by importance for a balanced and aesthetically pleasing smile. This thorough analysis helps orthodontists understand patient concerns, assess treatment options, and choose mechanotherapy for optimal smile design and overall outcomes.³⁷

Minimally invasive dentistry, focusing on prevention and early diagnosis, has evolved, emphasizing remineralization of noncavitated lesions and minimally invasive restorative approaches, marking a shift from traditional restorative methods.¹⁵

COLOUR

Shade matching is a critical aspect of achieving aesthetic success in restorative dentistry, particularly for anterior restorations. After addressing shape and occlusion, the final step involves accurately matching the restoration's colour to the natural tooth. While colour is a complex interplay of science and art, advancements in technology have significantly enhanced the ability to achieve clinically acceptable shade matches.²⁹

VITA Toothguide 3D-MASTER Instructions for Use – Example

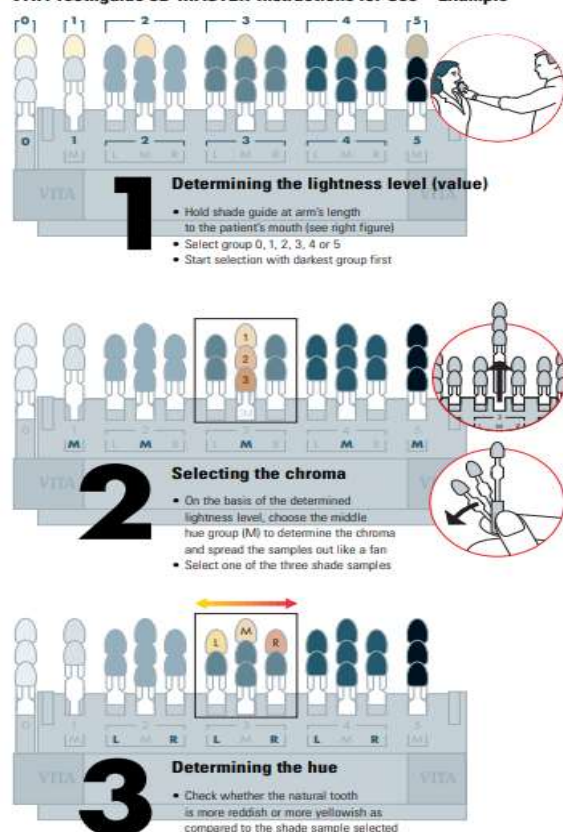


FIGURE 7. 3D shade guide

A comprehensive protocol for shade matching is outlined, incorporating both technology-based tools and conventional techniques like shade tabs and reference photography. This combined approach ensures a predictable and reliable shade match, reducing the likelihood of costly remakes. Proper execution of this protocol by dentists and technicians can lead to optimal aesthetic outcomes for challenging anterior restorations.

The Predictable Shade Matching Protocol is a systematic process for achieving accurate shade matching in restorative dentistry. The steps include:

1. Evaluation:

- Assess the patient's tooth type, considering translucency and opacity.
- Consider preoperative tooth condition and choose the definitive restoration material based on the stump shade.

2. Image Capture and Shade Analysis:

- Use technology-based tools like Spectro Shade Micro or conventional shade tabs.
- Ensure proper lighting and environment for accurate shade selection.
- Capture high-quality digital photographs for effective shade communication.

3. Transferring Information Into a Visual Format (Shade Communication):

- Combine reference photography and shade tabs to communicate precise shade information.
- Use black and white photographs to determine value.

4. Interpreting the Shade Information (Interpretation):

- Laboratory technicians interpret digital colour maps and reference photography.
- Understand shade tab selection, considering variations in value and chroma.

5. Fabricating the Restoration:

- Construct the restoration based on the assessed shade and chosen material.
- Apply staining and glazing to match the surrounding dentition.

6. Verifying the Accuracy of the Shade Match (Verification):

- Technicians verify the shade before returning the restoration to the clinician.
- Use shade tabs and an 18% gray card for precise verification.

7. Placement (Clinical Insertion and Cementation):

- Clinically fit the restoration to ensure a match with surrounding dentition.
- Repeat steps if necessary for a satisfactory shade match.

By following this protocol, clinicians and technicians enhance the predictability of shade matching, reducing the likelihood of costly remakes and ensuring optimal aesthetic outcomes for challenging anterior restorations.^{16,17}

ESTHETICS WITH COMPOSITES

Conservative dentistry, vital in addressing aesthetic concerns, favors directly bonded restorations due to their ability to satisfy patients in a single appointment and minimal tooth reduction. Composite materials, frequently used for these restorations, excel in replicating natural teeth.

Composites, multiphase substances with resin, filler, coupling agent, and initiators, ensure strong bonding while retaining individual properties. The resin matrix, commonly made of Bis-GMA resins, enhances stiffness, compressive strength, and reduces water absorption. Additional dimethacrylate resins may be added to improve filler loading.³⁰

Filler particles, including quartz, silica, and glass materials, provide dimensional stability to the soft resin matrix. Silane, a coupling agent, facilitates a strong bond during the setting process, while initiators and accelerators enable various cure modes.

Classified by particle size, shape, and distribution, composites include microhybrids, microfills, and nanofillers. Microhybrids offer high strength, suitable for stress-bearing areas, while microfills are ideal for enamel replacement due to excellent polish and wear characteristics. Nanofillers combine nanoclusters for improved properties.

Layering techniques, crucial for life-like restorations, involve using different shades to mimic natural teeth. Finishing and polishing, vital for durability and aesthetics, use diamond burs and polishing discs to achieve the desired contour and high gloss, resembling natural teeth.¹⁸



Figure 8 : Composite Restoration

Conservative dentistry using directly bonded restorations with composite materials is a valuable approach for solving aesthetic problems. Adherence to layering techniques and proper finishing ensures seamless, aesthetically pleasing restorations with excellent outcomes and longevity.¹⁹

ESTHETICS WITH CERAMICS

The rising demand for aesthetic dental restorations has led to an increased utilization of dental ceramics in both anterior and posterior regions. While traditional ceramics faced strength limitations, recent advancements, especially in zirconia-based materials, have expanded their applicability across the dentition. Zirconia, partially stabilized with yttrium oxide (ZrO₂-TZP), stands out with high flexural strength and favorable optical properties, making it suitable for root canal posts, implant abutments, and posterior fixed partial dentures (FPDs). Surface treatments can enhance zirconia's mechanical properties, but care is needed to avoid compromising its strength.²⁰

Esthetics are pivotal in dental ceramics, encompassing considerations like size, shape, texture, translucency, and colour. Zirconia-based ceramics offer desirable esthetic features, including translucency and shading adaptation.

In the fabrication of posterior FPDs, zirconia provides versatility owing to its mechanical, esthetic, biocompatible, and radiopaque properties. Although short-term data on zirconia-based FPDs show promise, cautious patient selection and precise techniques are crucial for success, with fracture being a primary mode of failure.²¹

Zirconium dioxide ceramics are commonly manufactured using computer-aided design/computer-aided manufacturing (CAD/CAM) systems. While zirconia-based restorations don't mandate adhesive interfaces, resin bonding can enhance retention, marginal adaptation, and fracture resistance. Surface treatments, like airborne-particle abrasion or hydrofluoric acid etching, further improve bonding to zirconia ceramics.

In conclusion, recent strides in dental ceramics, especially zirconia-based materials, have ushered in stronger and more aesthetically pleasing restorations. The evolving landscape of dental ceramics continues to provide dentists with diverse options to address both aesthetic and functional requirements across the spectrum of dental restorations.^{22,40}

ESTHETICS WITH VENEERS AND LAMINATES

Porcelain laminate veneers, a conservative and esthetic dental restoration method with a successful track record spanning over 25 years, boast high long-term success rates of 94% to 95%. The key to their durability lies in meticulous case selection, precise tooth preparation, and bonding to enamel for optimal bond strength.

The process kicks off with a thorough analysis of the patient's smile from multiple perspectives to identify misalignments or spacing issues. Aesthetic and functional evaluations ensure the proposed restorations align with the patient's needs. Treatment planning involves crafting a composite mock-up, aiding both the dentist and ceramist in visualizing the desired aesthetic outcome.^{23,24}

Tooth preparation is conducted carefully, with the aid of aesthetic pre-evaluative temporaries (APTs), transparent silicone-based provisionals. These guide the tooth preparation process, ensuring minimal healthy tooth structure reduction. Gingival margins are often finished supragingivally, and the final impression is taken for the ceramist.

The ceramist employs the same silicone index used for APTs in the laboratory procedures to create the final veneers. The choice of porcelain and layering technique may vary, emphasizing the need for precise communication between the dentist and ceramist.

In summary, the success of porcelain laminate veneers hinges on thorough analysis, meticulous planning, and effective communication between dental professionals and ceramists. By utilizing APTs and maintaining a conservative approach to tooth preparation, clinicians can achieve enduring and aesthetically pleasing results for their patients.²⁵

CONCLUSION

An ideal esthetic treatment plan seeks to preserve natural tooth structure, emphasizing form, function, and esthetics while prioritizing oral health and stability. Patient interviews uncover expectations and goals, enabling tailored treatment. Balancing the dentist's focus on health with the patient's desire for esthetics requires careful sequencing and communication. Analyzing face, lips, gingiva, and teeth collectively achieves symmetry. Tooth colour, shape, and position, alongside form and function, are crucial. Systematic approaches to direct composite restorations mimic natural teeth, combining esthetics and conservation. Interdisciplinary esthetic dentistry integrates esthetics, function, structure, and biology. Digital smile design enhances treatment planning, aiding in evaluating esthetics and improving patient acceptance.

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