

## Smile design and porcelain laminate veneers: Clinical aspects and considerations

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### Abstract

Smile design and makeover for contemporary esthetic dentistry are increasing among dental practitioners. Porcelain laminate veneers are the most used restorations for esthetics. This article provides the essential clinical aspects and considerations that every involved dental professional has to be aware of them. These are very important for a minimally invasive and highly esthetic treatment, with adequate function and a perfect integration that is in harmony with the patient's face, for the best outcomes.

**Keywords:** Smile design; Cosmetic makeover; Laminate veneers; Conservative dentistry; Esthetic dentistry.

### Introduction

Smile design involves many scientific principles that considered to create a beautiful smile. These principles can be established through data collection from patients, diagnostic models, dental research, and clinical measurements.<sup>(1)</sup> A cosmetic smile makeover has become a very popular procedure in the contemporary dentistry.<sup>(2)</sup>

Porcelain laminate veneers are steadily increasing in popularity among today's dental practitioners for conservative restoration for esthetics. Esthetic is a subject that is objective and necessitates excellent communication among the dentist, patient, and laboratory technician. Each case must be carefully selected and treatment planned to reach ultimate clinical efficacy and success of these restorations.<sup>(3)</sup>

This article provides the clinical aspects and considerations, essential for a minimally invasive and highly esthetic treatment, with adequate function and a perfect integration that is in harmony with the patient's face for the best outcomes.

#### 1. Smile Design and Makeover

The principles and concepts of smile design and makeover include three components; facial, dental and gingival components.

##### 1.1. Facial component

Considering the facial features is very important as a first step. Any attempt to define frontal beauty based on biometric measurements would not be valid because of the limitations imposed by the variety of racial, ethnic, and individual types.<sup>(4)</sup> Additionally, any alteration affecting the dentoalveolar support would have a direct influence on facial musculature.<sup>(5)</sup> Thus, protrusive outward roll of the upper and lower lip originating in a loss of skin and muscle tonicity takes part in the development of facial sagging.<sup>(6)</sup>

The tooth visibility is the amount of tooth exposure when lips and lower jaw are at rest. Tooth exposure

showed an increase from blacks to Asians and whites for the maxillary central incisors and a decrease for the mandibular central incisors from Asians to blacks and whites.<sup>(7)</sup>

Smile line is hypothetical curved lines drawn along the edges of the four maxillary anterior teeth that has to coincide or run parallel with the curvature of the inner border of the lower lip. The degree of curvature of the incisal line is more pronounced for women than for men. A pleasing smile is achieved when the angles of the mouth are parallel to the inter-pupillary line and the occlusal plane, with the tips of the canines barely touching the lower lip.<sup>(8)</sup>

Negative Space is the dark spaces that appear between the jaws during laughter and mouth opening. Dark space appears also between the outer surface of the maxillary teeth and the corner of the mouth in smiling, also called the "Buccal corridor".<sup>(7)</sup>

Smile symmetry refers to the relative symmetrical placement of the corners of the mouth in the vertical plane. The facial midline or dental midline act as the central point. Parallelism of lines must exist between the corners of the mouth or commissural line and the occlusal plane.<sup>(1)</sup>

Further facial components to consider include age of patient, lip line, upper lip curvature, occlusal line and occlusal frontal plane.<sup>(6)</sup>

##### 1.2. Dental component

The dental component consists of several concepts to consider. Dental midline is an imaginary vertical line that separates the two central incisors and a prerequisite, has been mentioned when dealing with smile symmetry.<sup>(9)</sup> Facial midline is a vertical line, drawn through the forehead, nose columella, dental midline, and chin. Dental midline does not necessarily coincide with the facial midline.<sup>(10)</sup>

Golden Rules (Golden Proportion) has been found that the majority of the proportions of beautiful smiles

do not coincide with the exact golden proportion formula. Canines displayed a larger width in females than in males. It indicates only the width. However, its perception is related directly to the height-width ratio and the objects next to them.<sup>(4)</sup>

The axial alignment and incisal inclination of maxillary anterior teeth becomes progressively more pronounced from the central incisors to the canine. The axis of the central incisors is usually slightly tilted distally towards the apex of the tooth when compared to the midline. The lateral incisors are inclined somewhat more distally toward the apical than the central.<sup>(11)</sup>

The term "Gradation" is when two similar structures are placed at a different distances from the viewer, the closest will appear the largest. The negative space created by the buccal corridor help in creating the gradation effect and illusion of depth. The buccal corridor should be bilaterally equal.<sup>(12)</sup>

The broad zone in which two adjacent teeth appear to touch is called the interdental contact area. The most incisal aspect of the contact area is called the contact point, after this point the two adjacent teeth diverge. The contacts are situated in a position that seems to go from incisal to cervical and from maxillary central incisors to canines.<sup>(13)</sup>

In a harmonious anterior dentition, the maxillary central incisors dominate in shape, size and position. To achieve an esthetically pleasing smile, the dentist should first decide on the appearance of the central incisors, followed by the laterals and the canines. The canines are also vitally important teeth as they form the junction between the posterior and anterior arch segments and support the surrounding facial muscles.<sup>(14)</sup>

The color of natural teeth is related directly to the correlation of enamel, dentin and light that appear during the light wave deflection and reflection process. The translucent regions of the tooth originate from the enamel that is free of interposed dentin. The cervical third contains the highest chroma, owing to its thinner enamel and more visible color.<sup>(15)</sup>

The dental morphology is evaluated in a three-dimensional way which is affected by:

- **Inciso-gingival height (incisal length):** The age and gender of the patient, along with the length and curvature of the upper lips well determine the length of the incisal edge.<sup>(16)</sup> Average anatomic crown length values for the maxillary central incisor range from 10.4 to 11.2 mm.<sup>(17)</sup> One of the most important factors is the visibility of teeth when the mandible and lips are at rest. A central incisor that is not visible when the lips are at rest, but can be seen when smiling, tend to render an older appearance to the dentition.<sup>(8)</sup>
- **Mesio-distal width:** It was found that the mean sex-specific incisor diameter was larger in men than in women as well as for black people than for whites.<sup>(8)</sup>

- **Shape of the teeth:** In the absence of documentation, such as old models or photographs, tooth shape, predominantly maxillary central incisors, not subject to rigid rules, must be selected according to a basic tooth design and evaluated and corrected in regard to its integration with the facial environment.<sup>(18)</sup>
- **Incisal embrasures:** When the dental arches separate, as in speaking or in a smile, a dark area can be seen in the anterior region between the incisal edges of the maxillary and mandibular teeth.<sup>(19)</sup> As the dentition progresses away from the midline, the size and volume of the incisal embrasures increase, it forms almost 90° between the canine and the premolars.<sup>(20)</sup>
- **Texture:** We are not only able to feel a surface texture, but we are able to evaluate it optically through the amount of light reflected or deflected, so that a tooth surface may be easily perceived as being smooth or rough.<sup>(19)</sup>
- **Other factors:** Including sex, personality, age, tooth contour, young and aged teeth.<sup>(3)</sup>

### 1.3. Gingival component

The gingival component considers gingival morphology and gingival contour. For gingival morphology, maintenance of a good healthy marginal periodontal tissue providing a pleasing esthetic appearance require a minimal width of 2 mm of attached gingiva.<sup>(17)</sup>

Regarding gingival contour, zenith points, interdental Embrasures, gingival level and harmony are what needed to be considered. The interdental papilla is the extension of the free marginal gingiva.<sup>(15)</sup> Its form and size are determined by the contact relationship of the adjacent teeth and the width of the proximal surfaces.<sup>(7)</sup> Healthy interdental papillae should be thin and terminate on the tooth in a knife-edged contour. The tip of the stable papilla maintains a distance of 5 mm from the intercrestal bone.<sup>(17)</sup>

### 1.4. Physical component

Visual perception and illusions are the main physical components. The perception of object's contour is dependent upon the deflection or reflection of the light that reaches them.<sup>(4)</sup> Reflection is related to the following rules: The greater the contrast the greater the visibility. Visibility increases with an increase in light reflection. Visibility diminishes as light deflection increases.<sup>(18)</sup>

### 2. Porcelain Laminate Veneers

Porcelain Laminate Veneer (PLV) is defined as a "thin bonded ceramic restoration that restores the facial surface and part of the proximal surfaces of teeth requiring aesthetic restoration".<sup>(21)</sup>

The indications of PLV include three types. Type I: Teeth resistance to bleaching, as in case of Tetracycline discoloration, and teeth unresponsive to bleaching procedure.<sup>(22)</sup> Type II: Major morphologic modifications, as in case of conoid teeth (peg shaped

laterals), diastema or interdental triangles to be closed, and augmentation of incisal length or facial contour. Type III: Extensive restorations needed because of extensive loss of enamel by erosion, or generalized congenital malformations.<sup>(23)</sup>

Contraindications of PLV include several situations. These include teeth exposed to heavy occlusal forces (Bruxism), severely malpositioned teeth, presence of soft tissue disease, highly fluoridated teeth, teeth in which color modification can be successfully achieved with various bleaching techniques, and teeth with extensive existing restorations.<sup>(23)</sup>

There are several complications of PLV including postoperative sensitivity, marginal discoloration, fracture, debonding, and wear of opposing teeth.<sup>(13)</sup>

### 3. Factors to Determine PLV Treatment Planning

Preoperative evaluation (Smile Analysis), photography and videotaping are essential factors to determine PLV treatment planning.<sup>(8)</sup>

Tooth position is a factor to be highly considered. The amount of sound tooth reduction is often related to the position of the teeth. In lingually aligned teeth, care must be taken not to reduce unnecessarily the facial structure of the tooth.<sup>(10)</sup>

The soft tissues, gingiva and bone height in relation to adjacent teeth should always be taken into account to avoid gingival asymmetry and to maintain the height of the interdental papillae.<sup>(2)</sup>

Ideally, gingival margins are preferably located on the enamel and away from the gingiva. Over extension of the preparation margins are necessary in these situations: previous restorations and carious lesions, defective enamel, gingival recession, root exposure, high lip line and incisal edge position.<sup>(12)</sup>

The PLV is not recommended in cases with occlusal problems such as cases with heavy function (cervical abfraction), parafunctional habits, and unfavorable occlusal relations.<sup>(9)</sup> Careful analysis to establish correct anterior guidance together with working and non-working contact is needed. Facebow transfer, centric relation, mounting on a semi-adjustable articulator, and diagnostic wax-up must be done.<sup>(13)</sup>

Aged or worn-out teeth exhibit different thicknesses of enamel and surface texture. Enamel may be so thin that any extra preparation may lead to a loss of this existing precious enamel, which will directly affect bonding.<sup>(24)</sup> The thinner the enamel gets, the more flexible the teeth become. The most important issue is not the strength of the ceramic material but the preservation of sufficient enamel and controlling the occlusal forces.<sup>(25)</sup>

## 4. Procedure and Clinical Steps

### 4.1. Laboratory communication

Discrepancies in tooth length, position, size proportion, color, function, phonetics and occlusion may cause disappointments. It is important to establish a good laboratory communication throughout the

procedure maintaining diagnostic study models, reference points, transferring the mock-ups, photography including full face, silicon index, radiographs, realizing the limitations, and wax-up.<sup>(26)</sup> In addition, patient expectation, color communication, shade tabs, translucency, detailed prescription, facebow transfer, and dentist-technician collaboration are of high importance.<sup>(14)</sup>

### 4.2. Actual material preparation

Following the facial preparation as stated previously, gingival preparation comes next. Chamfer finish line is preferred for all the gingival margins. This had the advantages of preserving tooth structure, gradual color transition, better esthetics, better emergence profile, and decrease stress concentration.<sup>(16)</sup> Thickness of enamel at the gingival third is 0.4 mm on the maxillary central incisors and only 0.3 mm on the maxillary lateral incisor.<sup>(17)</sup>

Proximal preparation and interproximal preparation are follow. Incisal preparation is considered with a feathered incisal edge, window design (intra-enamel), butt joint, and incisal overlap.<sup>(5)</sup>

Last step is finishing the preparation. This step includes removing the sharp angles, making incisal embrasures rounded and opened.<sup>(4)</sup> The use of magnification system is highly recommended.<sup>(9)</sup> The next step will be taking impression following final check, pre-sealing the exposed dentin, and cervical marginal check.

### 4.3. Impression making

Preserving the health of the gingiva is the key to successful impressions.<sup>(19)</sup> The contemporary most frequently used impression materials are polyvinyl-siloxanes. Single retraction cord can be used if the margin is subgingival or if the emergence profiles have to be checked. Double cord technique can be used to control tissue fluid.<sup>(15)</sup>

Noting the pouring time is necessary. Facebow Transfer and bite registration are to be taken.<sup>(11)</sup>

### 4.4. Provisionals techniques

Providing provisional is a mandatory step to maintain the preparation and the health of surrounding tissues for the time needed for the final restorations to be ready. These can be indirect (extra-oral), or direct (intra-oral). Details of types of provisional are not of the scope of this article, and can be founded easily through the prosthodontic books and literature.

### 4.5. Try-in step

In this step, several points have to be covered. These include individual evaluation, checking the margins, collective Try-in, checking the color, and altering the color.<sup>(27)</sup>

### 4.6. Bonding

The strength and durability of the bond between the tooth, the veneer and the luting resin is what importantly determines the success of the PLV treatment.<sup>(28)</sup>

#### 4.7. Postoperative instructions

As a “do” list, it is recommend to use a soft toothbrush with rounded bristles and floss, less abrasive toothpaste, soft acrylic mouth guard when involved in any form of contact sport, and ensure routine cleaning.<sup>(23)</sup>

In contrary, the “don’t” list include instructions of avoiding food or drinks that may contain coloring, not using alcohol containing drinks and mouthwashes at the first 48 hours, avoiding hard food and chewing on ice, and avoiding extremes in temperature.<sup>(8)</sup>

#### Conclusions

Understanding of these aspects presented in this article is a mandatory for the best of treatment outcomes. Each involved dental professional has to consider these principles from the very beginning of treatment plan through the clinical procedures and final cementation.

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