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Principles of veneer

A Project
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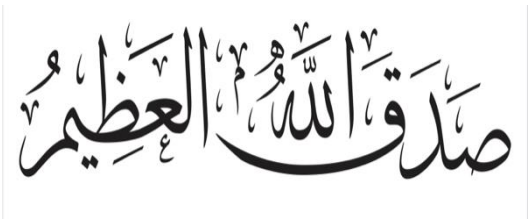

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Introduction

Facial aesthetics plays an important role on an individual's well-being, self-esteem, emotional condition, social success, and even chances to get a job. The smile is primordial in the search for an optimum dentofacial aesthetic standard. An aesthetic smile depends on the harmony of shapes and shades of anterior teeth. In addition, the alignment of these teeth and their harmonic positioning on the arch are the basics to obtain this aesthetic balance[1,2]. However, teeth are not always distributed on a harmonic way on the dental arch. This lack of harmony may have different origins, such as genetic or developmental tooth anomalies, structural changes caused by caries, and chromatic changes or injuries in the dental structure due to traumas.

When these alterations take place on the labial surface of anterior teeth, or even on the buccal surface of premolars, one treatment option can be the total covering of the surface using a restoration called a **laminate, veneer, or facet.** This restoration is used to cover an unsightly area by bonding to the facial surface of the prepared tooth [3].
The concept of coverage of the labial surface of anterior teeth due to aesthetic reasons started back in the 1930s, when Dr. Charles Pincus introduced the technique of ceramic veneers, to attend aesthetic demands of Hollywood artists. Veneering doesn't aim only aesthetic recovery but also preservation of tooth structure, limiting the periodontal and pulp involvement that may result from more invasive procedures, such as full crown preparations.

1-Indication and contraindication for veneer

Indication

- teeth with discoloration, such as those affected by amelogenesis imperfecta, physiological aging, trauma, fluorosis, or stains caused by tetracycline intake.

However, it is vital to note that dental bleaching should always be the first treatment choice in those cases Therefore, only teeth that do not show a satisfactory response to bleaching should receive veneers.[23]

- teeth with extensive caries lesions or fractures, presence of multiple restorations with unsatisfactory shade
- rotated or inclined teeth.
- necessity of reduction and closing of diastema.
- in the cases of developmental anomalies like short teeth which require increasing of its length, misshapen peg-shaped maxillary lateral incisor, microdontia and Hutchinson's incisors.
- aesthetic transformation (canines into lateral incisors and lateral into central incisors) in orthodontic treatment for closure the space duo to loss of upper lateral incisor.[24]

Fig1: Hutchinsons incisors

Fig2: Pig lateral

contraindications for veneers

- patients with bruxism or parafunctional oral habit.
- edge-to-edge occlusion of the anterior teeth.
- anterior teeth with large destruction of the crown.
- when there is not enough remaining tooth structure to support the veneer.
- high caries disease activity associated with bad oral hygiene.
- Presence of periodontal disease.
- teeth with excessive labial inclination. [25]

2-Esthetic Evaluation

During clinical examination, it is fundamental to explore the patients' estimate of dental esthetics.[26]
However, some objective parameters can be used to identify the most expressive changes that may compromise oral esthetics. Many characteristics of teeth and gingiva, such as tooth dimension clinical crown width-to-length ratio, color, shape, and gloss, among others, as well as gingival shape, contour, embrasure, zenith, and height (position or level), are part of what is called microesthetics. These parameters cannot be analyzed separately, although being very important to result on a pleasant smile (miniesthetics) but in association with a harmonious face (macroesthetics) to result in good self-esteem (hyperesthetics).[27]

2.1 PROFILE VIEW

The profile can be evaluated by joining three points (glabela, subnasal and pogonion) and the so formed internal angle. The overall harmony of the forehead, midface and lower third is evaluated with this angle.[28]

1. normal: forms angle of approximately 170°; (Figure 3)
2. convexity lower than 170° as a function of most posterior position of pogonion and suggests skeletal Class II. A Class ll or convex profile patient, has little dominance of a central incisor; and (Figure 3)

3. concave: greater than 170° as a function of most anterior position pogonion and suggests skeletal Class III.

Figure 3

2.2 Soft tissue composition

2.2.1 Gingival Analysis

The borderline of the dental crown and the gingival tissue determines the so-called gingival line, which also interferes with the harmony of the smile. For its evaluation, a straight line is traced from the highest point of the interface between the tooth and the gum, known as the gingival zenith, from the right to the left maxillary canine. (Fig.4)[29]

Figure 4

The tooth- gum interface of both central incisors should be on this line, while the lateral incisors are approximately 1.5 mm below this line.[5] The gingival line is preferably parallel to the occlusal frontal line. The gingival zenith of the homologous teeth should be on the same plane, guaranteeing the symmetry of the dental-gingival composition. Since the long axis of the anterior maxillary teeth is slightly inclined to the distal, the gingival contour does not form a symmetric arch, and the gingival zenith is slightly displaced to the distal side[5](Fig.5)

Visibility of the gingival contour during a broad smile largely contributes to facial esthetics. Corrections on the gingival contour can be obtained by surgical techniques, such as gingivectomy or coronally advanced flaps.

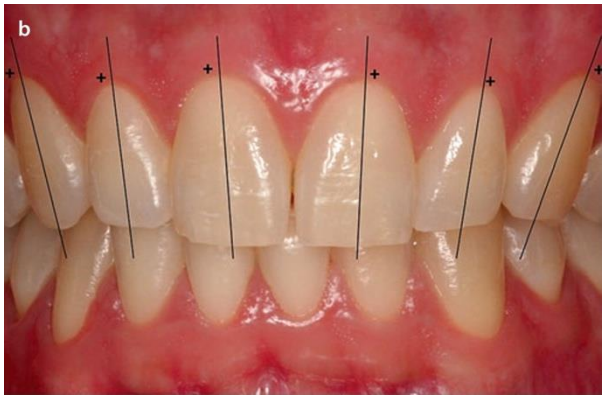


Figure 5

Gingival zenith: The gingival zenith is the most apical aspect of free gingival margin. The purpose of this study was to quantify some clinical parameters useful as esthetic guidelines when gingival contour is modified and to compare the left and right sides of six maxillary anterior teeth. (Fig.6)[30]

Figure 6

2.2.2 Lips

The relation between lips and teeth is also fundamental for the beauty of a smile. The quantity of dental exposition while smiling depends on many factors such as muscle contraction, the gingiva level, skeleton particularities, tooth shape, and the presence of dental wear.[31]

Smile Line

The incisal edges of the anterior maxillary teeth form a curve, called incisal line or smile line, with the lowest part in region of the central incisors. During a maximum smile, those edges are supposed to softly touch the lower lip (Fig.7). curve formed should be parallel to the curve of the lower lip The degree of curvature of the incisal line is more prominent in women than in men.

Figure 7

lip line

The line formed by the upper lip border is called upper lip curvature or lip line. On a maximum smile, the upper lip should translate up to the gingival line, which happens in 70% of the population. The ideal upper lip curvature is obtained when the lip reaches the edge of the interdental gum.

About 10% of the people have a very high upper lip curvature. Every time this line surpasses more than 2 mm of the gingival line, an esthetic impairment is noticed, causing the so-called "gingival smile" or "gummysmile" [32]

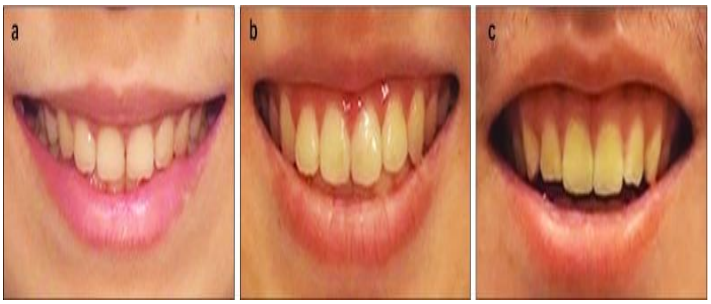


Fig.8: Upper lip curvature. (a) Upward. (b) Straight (c) Downward

2.3 Dental composition

2.3.1 Dental Dimensions and Proportions

The dental dimensions and clinical crown width-to-length ratios, part of what is called microesthetics, have a large influence on the esthetic of the smile.

- upper central incisor corresponds to about 80% of its length, with variations between 75% and 85% [6].
- The upper lateral incisors have the shape and contour similar to the central incisors, although with a smaller width of about 2–3 mm [13]. The length of the crown is about 1–1.5 mm shorter (approximately 20%) than the central incisors.
- The upper canines are about 1–1.5 mm smaller in width than the central incisors, even though having a similar length, with a variation of only 0.5 mm [6].

2.3.2 Dental Reference Lines

The occlusal frontal plane or line
is a connection between the tips of both maxillary canines. This line should be parallel to the **interpupillary line** and to the line that connects both labial commissures, **the commissural line** (. Fig.9). The **facial midline** is perpendicular to those two lines.[4]

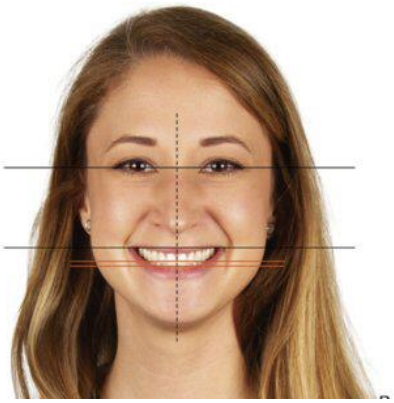


Figure 9

dental midline
is traced between both maxillary central incisors, and it should be perpendicular to the occlusal frontal line (Fig.10a,b). Other than that, it should be coincident with the facial midline of the patient, even though small asymmetries do not impair a great deal of the esthetic. The facial midline and dental midline coincide in only 70% of the people, while the dental midlines of the upper and lower arches do not coincide in almost three-quarters of the population.[33]

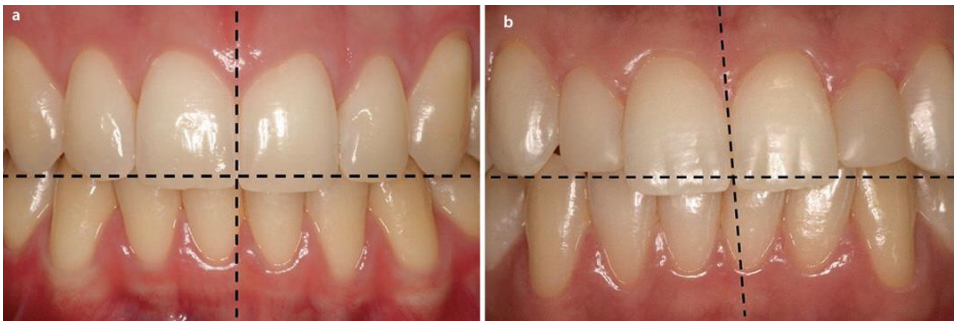


Figure10

Note (figure 10) shows Relation between the dental midline and occlusal frontal line. a Midline perpendicular to the occlusal frontal line; b midline inclined in relation to the occlusal frontal line.

2.3.3Degree of tooth display

When the mouth is relaxed and slightly open, 3.5 mm of the incisal third of the maxillary central incisor should be visible in a young individual. As age increases, the decline in the muscle tonus results in less tooth display

2.3.4 Phonetics

Phonetics is a major determinant of the tooth length. In order to determine proper lip, tongue and incisal support and tooth position, necessary that the patient sits either erect or stands during the phonetic exercises.

Phonetics used are as follows:

- when the patient says "M," there should be an exhibition of 3–4 mm of the incisal edge of the central maxillary incisors in young women or 1–2 mm in men. After 40 years of age, the quantity of exposition of the incisal edge decreases in about 1 mm per decade, while it increases the exposition of the lower incisors [7].

- When the patient says "E," a space between the upper and lower lips will form. If less than 50% of this space is occupied by the maxillary central incisors, probably, a lengthening of the tooth will improve the esthetic of the smile. On the other side, if more than 70% of space is occupied by the maxillary incisor, the lengthening of the incisor will not be pleasant [7].

- When the patient says "V" or "F," the edges of the upper central incisors should slightly contact the border of the lower lip [7].

2.3.5 The incisal embrasures

The size of the incisal embrasures changes with age. In young individuals, the incisal embrasures are large and open increasing from the midline to the canine, (Fig.11a). With aging, the size of the incisal embrasures decreases and may disappear completely because of tooth wear (Fig.11b).

If the interdental contact is positioned too far away from the incisal area, a too large embrasure leaves an unnatural appearance (Fig.11c). If the contact does not extend far enough toward the gum, the interproximal space will be open, creating a dark triangle (Fig.11d).[34]

Figure 11

3-Basic Principles for Veneer Preparation

The preparation for direct veneers is very conservative as only a thin layer of the labial tooth surface is removed. The depth of the preparation will depend on the area of the tooth, intensity of chromatic alteration, shape, and position.

In relation to the area of the tooth, It is known that the thickness of the enamel in the cervical region less than thickness in medium third and incisal third.

Concerning the tooth's shape, small or peg- shaped teeth will require less removal of tooth structure to cover the surface with restorative material, aiming to obtain the necessary material thickness and good aesthetic results. In the same way, lingually inclined teeth may require minimum or no preparation of the labial surface.[35]

Control of reduction with silicone guides. The preparation design for ceramic veneers should allow for an optimal marginal adaptation of the definitive restoration and maximally resembling the ideal tooth morphology. Therefore, a diagnostic wax-up should be utilized as a reference for tooth reduction [36]

Fig.12(a) silicone index

Fig.12(b)wax up

When the preparation is necessary, the depth of wear has a direct influence on the establishment of the desired ceramic veneer shade after_cementation. A 0.9 mm wear of the substrate is capable of promoting a change from an A4 shade to an A1 shade (Vita Classical® shade guide, Vita, Germany); a reduction of 0.5 mm creates a shift from an A4 to an A2; a reduction of 0.3 mm does not produce any color change; rather, final color adjustments with resin cement are necessary.[37]

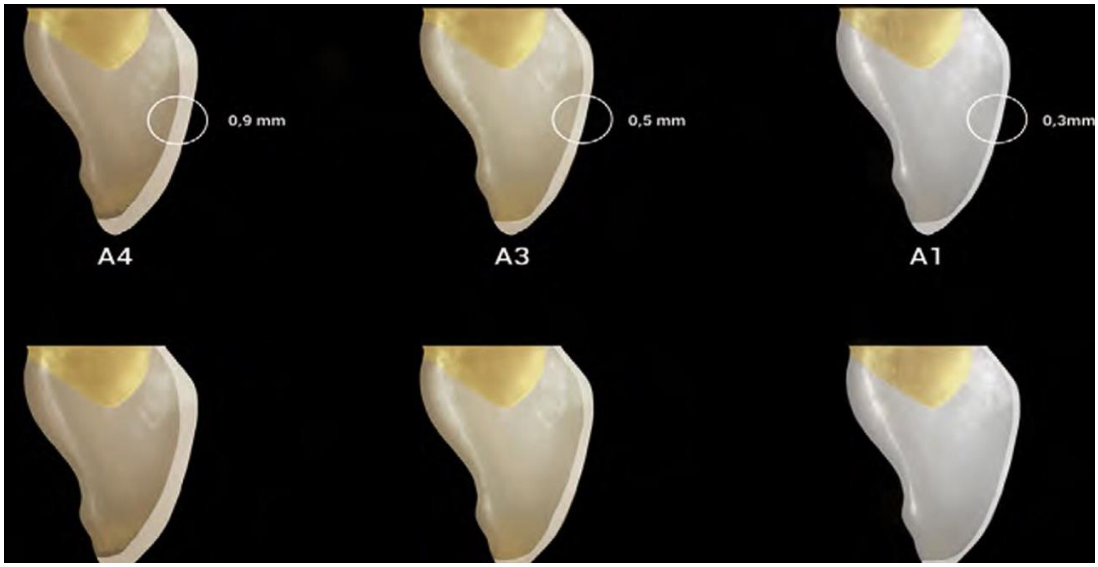


Figure 13

The outline form of the veneer tooth preparation

The outline form of the veneer tooth preparation is determined by the surrounding structures, i.e., gingiva and neighbor teeth.

- Regarding the cervical cavosurface margin of the preparation, the height of the lip line during the maximum smile is important to determine its limit.

  Patient suffering from gum smile or show gingival margin during maximum smile. Thus, if the tooth-restoration interface is prepared close to or slightly before the gingival margin may be aesthetically unacceptable and any defect interfacial defect of the restoration may promote biofilm deposition in this area, leading to gingival inflammation, even though it might be mild. So To obtain a completely hidden tooth- restoration interface, the margin of the preparation has to be placed inside the gingival crevice.[38]

  If the tooth-restoration interface is prepared close to or slightly before the gingival margin, it may contribute to the health of the surrounding soft tissues. However, this position of the margin can only be possible on patients that do not show gingival margin during maximum smile and present little or no color alteration of the tooth, or on the

patients that do not mind having a less favorable aesthetics at this area, aiming to protect the gingival health.

- In relation to the proximal margins of the preparation, on teeth with slight color alterations, they should be placed before the proximal contacts. However, on teeth with intense discoloration, the preparation must go further as half the contact area, in such a way that the dark background would not be visible after the restoration.

  When there are diastemas, the preparation should extend to the interproximal surfaces, allowing the correct restoration of the proximal contour.when performing the proximal reduction, the adjacent teeth should be protected with a steel strip.

- In relation to outline in the incisal edge, there are three possibilities as in figure14.
  - ✓ The type I (or window preparation) has a feathered edge.
  - ✓ The type II has an incisal reduction and a butt joint.
  - ✓ The type III (or wrap preparation) has an incisal reduction associated with a palatal chamfer [8] (the palatal chamfer effectively counteracts shear stress in the incisal area, due to inter-incisor contacts during protrusive movement of the mandible, allowing a safe incisal disocclusion guide. This design also provides a definite seat during cementation) [9].

  the last two types also known as **overlapped incisal edge preparation.**

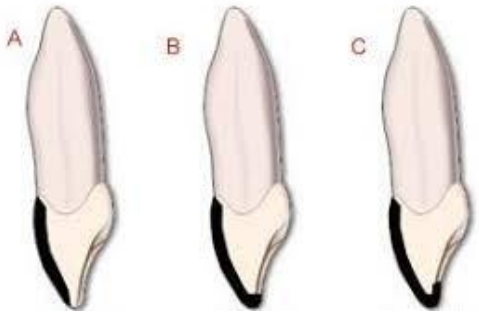


Figure 14

For direct composite veneer restoration on teeth with thick incisal edges, the feathered-edge preparation should be chosen. However, on cases of patients with very thin incisal edges that are susceptible to fractures, or when teeth need to be elongated, as well for all indirect veneers, an overlapped incisal edge preparation with butt joint or a palatal chamfer should be performed.
As in most clinical cases, the direct veneer preparation is restricted to enamel, and it usually does not lead to postoperative complications, from the pulpal or functional point of view. From the periodontal point of view, a correct cervical anatomy and the perfect fitting of the veneer to the preparation, at this region, avoid alterations of the periodontal tissues [10].

In some cases, veneers have shown to be a better choice than full crowns, in particular for patients with deep overbite, where there is usually not enough space on the lingual tooth surface; or for the mandibular anterior teeth, where it is easier to preserve the pulp integrity than on the full crown preparation.

4-Direct Veneer Restoration

4.1 Indication and contraindication for direct veneer

Indication

1. Discolorations of teeth or restorations,
2. dental malformations or mal-positions,
3. diastemas, crown fractures
4. abrasive or erosive defects
5. Enamel hypoplasia (developmental malformation generally resulting in poor aesthetics, tooth sensitivity, malocclusion and predisposition to dental caries).[10]
6. Underdeveloped teeth, such as a peg lateral.

Contraindications:

1. Contraindications include limitations. One must be very aware of the limitations that prevent the opening of the bite for one reason or another. The best way to evaluate whether it is possible is to add some composite incrementally to the posterior dentition. A night guard also opens a patient's bite. Then the patient can determine if he or she is comfortable in that raised vertical position.
2. Contraindications to using direct composite bonding include gross loss of tooth structure where composite would not be strong enough. In these cases a porcelain, crown, or veneer may be more suitable.
3. A grossly decayed or brittle teeth or poor oral hygiene are also negative indicators. With poor hygiene it is diffcult to maintain the margins, and decay will reoccur.[10]

4.2 Material

direct technique using resin composite

Resin composite materials consist of five key components:

(a) organic monomer (resinous) matrix.
(b) Si- based glass fillers (for strength and X-ray opacity).
(c) a silane coupling agent (for adhesion promotion).
(d) pigments (for aesthetics).
(e) activators, inhibitors, and stabilizers (for setting reactions) [11,12].

To restore the labial surfaces of teeth after veneer preparations, a resin composite material with excellent polishing characteristics should be selected.

Before performing the final veneer, a restoration mock-up can be done, using the same composite, shades, and thickness layers of the final restoration. The materials should be applied over the teeth without any previous adhesive

treatment. After curing, the restoration mock-up is evaluated, and if it is not the one desired, it can be easily removed by pulling out the veneer by its margin, with the aid of an exploratory probe. Then a new composite mock-up can be placed and evaluated. This will also allow the dentist to evaluate whether the depth of the preparation performed, when associated to characterization material and composites, is enough to hide any altered background color the tooth may present. If necessary, a deeper preparation can still be done. [39]

Isolation of the operating field can be performed with gingival retraction cord and cotton rolls, or with a rubber dam associated with clamps to expose the margin of the preparation. [40]

In the case of heavily discolored teeth or when there are several shades on tooth surface after preparation, due to several previous restorations, a thin layer of opaque light-curing viscous liquid characterization material, also known as color modifier, tint, or masking agent, can be used to create a whiter homogeneous surface color.[41]

After that, a thin layer of dentin shade composite should be used, to mask the intense opacity of the tint, followed by a final layer of more translucent enamel shade composite, to reproduce enamel characteristics [42]

4.3 Advantages and disadvantages of direct veneer

Advantages

- direct venners is generally more conservative
- Direct veneer restoration is therefore a faster technique and can be finished in a single appointment.
- Direct aesthetic veneers can be a very practical intervention and the tooth preparation is usually limited to the labial surface of the teeth.
- Inexpensive in compared to indirect veneer. [43]

Disadvantages of direct veneer

- color stability depends on factors inherent not only to the composite used but also to some patient's habits like Frequent consumption of food and/or beverages with dyes, as well as smoking habit diminishes the veneer durability.
- There is also the possibility of incorporation of air bubbles during the composite layer application, therefore creating areas even more susceptible to staining and degradation.
- direct veneers is the need of the clinician's skills to create the aesthetic characteristics, such as shape, texture, contour, and shade.
- less indicated when all anterior teeth need to be covered by a veneer.
- In the case of highly discolored teeth, it is hard to obtain adequate color match and natural translucency with direct veneers.

5- Indirect Veneers

The indirect veneers can be performed with composites or ceramics. As the restoration is prepared outside the mouth, an impression or scanning of the preparation is necessary, in order to create the restoration over a cast or milling it in CAD/CAM machine.

5.1 Indications and contraindication of indirect veneer

Indication

1. Dark or stained teeth.
2. Dental calcium deficiency.
3. Multiple diastema.
4. Lateral wedge.
5. Chipped teeth.
6. The lingual position of the teeth.
7. Deformed teeth do not require orthodontics

Contraindications

1. Available enamel
2. Ability to each enamel
3. Oral habit like bruxism
4. Patient with high caries
5. Compromised periodontal health
6. Endodontically treated

5.2 Material

Dental Ceramics

Ceramic is defined as something made from nonmetallic material by firing at high temperature. The dental ceramics are widely used biomaterials in prosthetic dentistry, because of their attractive and well-studied clinical properties. They have basically three indications in dentistry:

(a) ceramic- metal crowns (porcelain fused to metal, PFM) and fixed partial dentures.[44]
(b) all-ceramic restorations consisting of crowns, inlays, onlays, indirect laminates (veneers), and short-span anterior bridges.
(c) ceramic denture teeth.[45]

Porcelain

Traditional feldspar-based ceramics are also referred to as "porcelain." They are silicon based and made of aluminosilicate minerals, such as quartz feldspar and kaolin.

Advantages of porcelain

1. Typically, dental porcelain is composed of ca. 73–75% feldspar and ca. 22–25% quartz. To increase the workability of the unfired porcelain, and to impart X-ray contrast, some kaolin needs to be added.

2. Pigments are important to provide the required aesthetic shade and hue.[4]

Disadvantages of porcelain

1. very high glass content.
2. It is Brittle.
3. Has low fracture toughness and flexural strength.
4. Due to the limited thickness in indirect laminates and the material's properties, the clinical success of porcelain veneers relies on reinforcement of the restorations by adhesive cementation [13]

Porcelain laminate veneers offer a predictable and successful restoration with an estimated survival probability of 93.5% over 10 years. Significantly increased failure rates were associated with bruxism and nonvital teeth, and marginal discoloration was worse in patients who smoked according to study about Clinical performance of porcelain laminate veneers for up to 20 years by Ulrike Stephanie Beier et al. Int J Prosthodont.Jan-Feb 2012.[14]

Composite

Indirect technique refers to fabrication of the restoration outside the oral cavity in the laboratory following which it is luted to the tooth with resin cement. There are two types of indirect composite restorations, first and second generation of indirect composite restorations.
The first generation of indirect composite restorations was introduced in the 1980s. These restorations have shown failures in clinical studies.
Indirect system requires an impression to fabricate the inlay in the laboratory. These materials have improved physical properties, resistance to wear and attain a higher degree of polymerization. The polymerization shrinkage does not occur in the prepared tooth, so induced stresses are reduced which reduces the potential for leakage.[46]
To overcome the disadvantages of first generation indirect composites, in the early 1990s, a second generation of indirect composites was introduced which included microhybrid composites with fillers of approximately 66% by volume. This resulted in improved mechanical properties with flexural strength in the range of 120–160 MPa and elastic modulus of 8.5–12 GPa. [47]

Advantages

1. improved wear resistance.
2. reduced polymerization shrinkage.
3. improved fracture resistance.
4. biocompatibility. [48]

Disadvantages

1. increased cost and time
2. requires two appointments
3. fabrication of a temporary restoration
4. low potential for repair.

For up to 3 years of function, all-composite resin single-tooth restorations have inferior success rates compared to all-ceramic restorations. Due to the inferior esthetics and wear resistance of all-composite resin crowns, all-ceramic crowns remain the preferred treatment for CAD/CAM-generated metal-free single-tooth restorations according to study performed in May-Jun 2010 about Computer-aided designed/computer-assisted manufactured composite resin versus ceramic single-tooth restorations: a 3-year clinical study by Sara Vanoorbeek et al. Int J Prosthodont.[15]

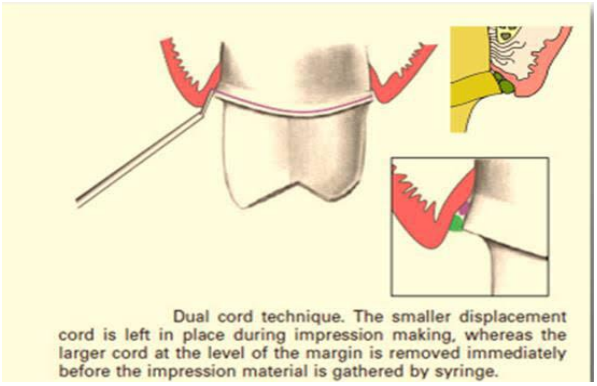
5.3 Impression/Scanning of the Tooth Preparation

the first step to obtain a proper impression is to perform the gingival displacement. For that, a retraction cord is gently placed inside the sulcus using a retraction cord packer.

Fig. 15a: Retraction cord

Fig.15b: Retraction cord packer

The cord must be placed beneath the finishing line to avoid interferences during the impression, for capturing the details of the gingival cavosurface margin. After that a low viscosity elastomeric impression material (addition silicones and polyethers) is applied over the preparation, followed by the putty material previously loaded inside an impression tray. The retraction cord can be left in place during impressioning, being generally removed in the mold. The gingival displacement can also be performed with the double- cord technique. A thin retraction cord (000) embedded in hemostatic solution is placed inside the gingival sulcus, and over it a thicker one (00).



Dual cord technique. The smaller displacement cord is left in place during impression making, whereas the larger cord at the level of the margin is removed immediately before the impression material is gathered by syringe.

Figure 16

The one step silicone impression technique can be used. For that, immediately before the impression, the thicker cord is removed, and the low viscosity material injected around the tooth preparation. The putty impression material is mixed, applied inside metal trays and immediately placed intraorally, letting the materials to polymerize simultaneously. A high-accuracy type IV dental stone is poured into the mold. After its hardening, a replica is obtained, which is positive reproduction of the soft tissues and teeth. The cast is then sent to the dental technician to prepare the laminate. Another option is to perform a 3D digital impression, scanning the tooth preparation using an optical intraoral scanner. The information is digitalized, and a virtual 3D model is created. A dedicated software is used for restoration design process. The milling unit is used to mill the laminated from ceramic or composite blocks.

5.4 Shade selection

Although the visual observation method has proven character in many students, a visual comparison between natural teeth and an artificial shade guide remains the primary means of choosing the shade used in dentistry. The first shade guide, containing 60 color samples, was created by Clark in 1930,10 since then, several studies have been conducted to improve clinical application, but without significant changes.[16]

The VC shade guide

the VC shade guide (Fig. 18) has gained popularity as a chromatic standard for ceramic systems from various manufacturers. This shade guide contains color tabs in four shade groups: A (brown), B (yellow), C (gray) and D (red). Different degrees of saturation (chroma) of the same hue can be observed, expressed in numbers as shown in figure.

Figure 17

For decades, the VC scale has been considered among the shadow reference guides, although early studies have also described problems with its use. Among these problems:

- there is an inconsistency in the colorimetric coverage range.
- loss of clinical time.
- the impossibility of obtaining the perfect colorimetric sample.[17]
- The difference in shape and structure of the teeth and of the specimens
- color variation between specimens of the same designation is often described in the same brand scales.

V3DM Shade Guide

The V3DM Shade Guide (Fig. 19), developed in 1998, presents its color tabs arranged in five groups, according to value. According to the manufacturer, unlike its predecessor, which was developed experimentally, this shade guide is designed to meet modern aesthetic concepts. It has 26 color tabs distributed in five groups defined by numbers (1, highest value; 5, lowest value).

Figure 18

Several studies have reported an optimal distribution of V3DM guide tabs compared to other shadow guides [18].According to these studies, this shade guide provides greater precision and uniformity in tab distribution, allowing for greater accuracy and ease of shade identification. Another study, however, showed that this shade guide, although more consistent than the others, also displays chromatic gaps and limitations.

Shade guide selection for ceramic veneer

Ceramic veneers are manufactured with varying thicknesses, which may vary from 0.3 mm to 1.5 mm, having varying degrees of translucency. Generally, increasing the thickness of the ceramic veneer is proportional to the decrease of translucency, which increases the influence of the veneer and reduces the influence of the resin cement on the final chromatic result.[19]

Unlike when the restorations are fabricated with direct composite resin in that case the color selection and reproduction are performed by the same individual. For indirect restorations Shade guides are essential for communication of the color dimensions The shade guides do not provide all of the features to be reproduced and may be used in conjunction with evaluation tools, chromatic maps and a suitable photographic documentation.

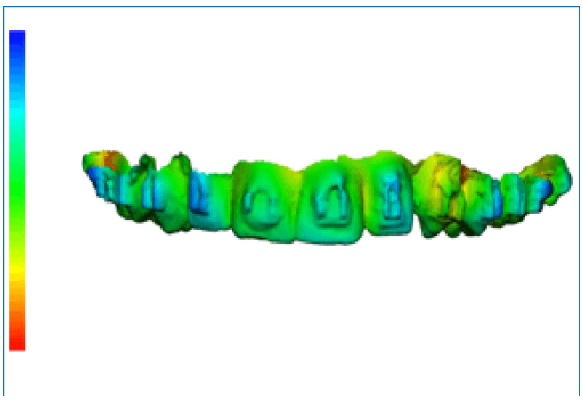


Figure 19

Example of chromatic map according to point-to-point distance between the two 3D models: blue areas are more vestibularized, whereas red and yellow areas are less vestibularized .

5.5 Provisional Restoration

Some indirect restorations are performed chairside, such as when a CAD/CAM system is available in the dental office.

However, when the final restoration will be prepared by an external laboratory, an interim restoration will be required.

When a single tooth will receive the provisional restoration, a plastic clear crown form (Fig.21)can be used as a matrix to restore the external anatomy of the tooth.

Fig.20 Polyvinyl chloride transparent strip crowns

The crown form is placed on the tooth and the excess is trimmed. A direct composite is applied inside the form, which is taken in position.

After light-curing the matrix is removed, while the composite stays in place. The margins are checked, and any excess can be removed with a scalpel blade. Generally, the temporary restoration remains in place without any adhesive application, solely through mechanical retention. [20]

5.6 Try-in Procedure

- Each laminated must be tested into the preparation for fitting.
- For that the provisional restoration is removed with an instrument.
- The preparation is cleaned with pumice and a prophylaxis rubber cup or brush, followed by washing and drying.
- Any residues of temporary cement must be removed
- The internal area of the laminate is moistened with water or glycerin and the restoration is placed.
- Inadequate seating can be diagnosed by using a low viscosity silicone material . The internal adjustments can be performed with small round fine diamond points.
- To verify the shade of the restoration, water-soluble try-in pastes that simulate the optical characteristics of the resin cements can be used to select its color.
- The try-in paste is applied in the internal side of the restoration, which is placed in position like will be performed during the final luting.
- The test should start with an untinted and transparent try-in paste.
- If the first shade is not adequate, the laminate and the preparation are washed, and a new shade is tested, until defining the correct one for that clinical case.
- No occlusal evaluation should be performed before the cementation, to prevent unforeseen fracture of the fragile laminate.[20]

5.7 Cementation of Indirect Veneers

Classification Resin Cements

Conventional

- Self-curing
- Light-curing
- Dual

Self-Adhesive

- Dual

Conventional Self-Curing Resin Cement

The polymerization reaction is completely chemical.

These cements are the oldest, their use implies the mixture of two pastes, base and catalyst which, when mixed, initiate a polymerization reaction. [49]

Fig.21a: Self-curing resin cement

Fig.21b: Base paste

Advantages

Complete chemical polymerization irrespective of the thickness of the restoration. [50]

Disadvantages

- Less work time,
- difficulty when removing excesses,
- Color instability
- technical sensibility [51]

Indication

Less translucent or thicker restorations: crowns, inlays and onlays, PFM [52]

Brands

Multilink® (Ivoclar Vivadent)
Panavia 21® (Kuraray)
C&B® (Bisco)

Conventional Dual Curing Resin Cement

Advantages

- Greater degree of conversion due to two types of polymerization
- greater control over working time
- easy removal of excess and superior mechanical properties [53]

Disadvantages

- Color instability therefore contraindicated for use with veneers.[21]
- These cements also do not have a wide range of shades from the majority of manufacturers, which decreases the dentist's ability of combining the veneer shade with the other teeth through the use of the cement
- they do not offer try-in colored pastes, which also restricts their usage when it comes to very thin veneers.

- their working time and degree of flow increases the difficulty of their use and limits their indication.[22]

Indication

Less translucent or thicker restorations: crowns, inlays and onlays, PFM [54]

Brands

Variolink II® (Ivoclar Vivadent)
RelyX ARC® (3M ESPE)
Nexus® (Kerr)
Calibra® (Dentsply)
RelyX Ultimate® (3M ESPE)

Figure 22(a) .

Figure 22(b)

Conventional light Curing Resin Cement

Advantages

Color stability
greater control of working time
easy removal of excess
try-in color pastes [55]

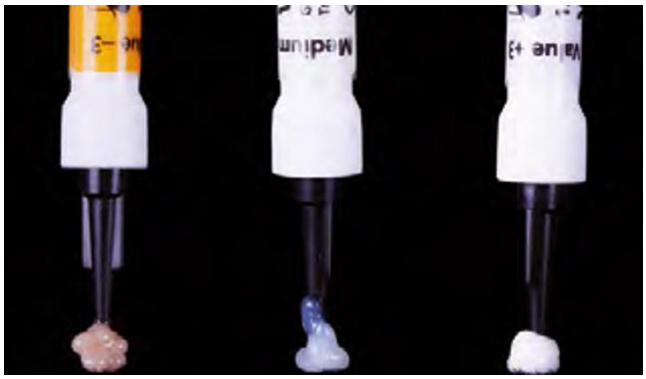


Fig.23shaded try-in light-curing resin cement pastes

Shaded try-in light-curing resin cement pastes (Variolink Veneer®, Ivoclar Vivadent, Liechtenstein).

Disadvantages

Polymerization totally dependent on light

degree of conversion influenced by the thickness of the restoration technical sensibility [56]

Indication
Translucent or thin restorations: veneers and fragments

Brands
Variolink Veneer® (Ivoclar Vivadent),
Rely X Veneer® (3M ESPE),
Nexus® (Kerr),
Vitique® (DMG)

Fig24

Figure 26 Light-curing resin cements (Variolink Veneer®, Ivoclar Vivadent, Liechtenstein).

Dual Self Adhesive Resin Cement
Advantages
Simplified technique involving fewer clinical steps and good control over working time[57]
Disadvantages
Bond strength even lower than that of systems using adhesives [58]

Indication
Less translucent or thicker restorations: crowns, inlays and onlays, fiber posts and PFM restorations

Brands
MonoCem® (Shofu), RelyX U 200® (3M ESPE), Maxcem Elite® (Kerr), Clearll SA® (Kuraray), BisCem® (Bisco), SpeedCem® (Ivoclar Vivadent).

Figure 25

As shown in the figure Self-adhesive dual-cure resin cement (RelyX U200®, 3M ESPE, USA),Self-adhesive dual-cure resin cement (MonoCem®, Shofu, Japan) and Self-adhesive dual-cure resin cement (MaxCem Elite®, Kerr, USA).

5.8 Finishing and Polishing

- the dynamic occlusion contacts must be evaluated with a thin articulating paper.
- The anterior disocclusion guide must occur without excessive stress concentration in just one tooth.
- The canine disocclusion guide must also be evaluated.
- Any adjustment can be performed with a fine-grit diamond points or 30-flutted carbide bur.
- T he finished areas must be properly polished using abrasive rubbers, disks, or polishing pastes with felt disks, using progressively finer abrasives. (fig28)

figure 26

- whole margin must be evaluated with an exploratory probe and any excess must be removed using a very thin grit needle shaped diamond point.

- Any excess in the interproximal area must be detected with dental floss and removed with abrasive strips.

- The margins of the restorations should be reevaluated in the next dental appointment to detect any remaining discrepancy[20]

5.9 Advantages and disadvantages of indirect veneer

advantages

- greater durability
- color stability
- do not suffer abrasion or discoloration

Disadvantages

- the preparation generally goes further than labial surface.
- Require additional steps are necessary, such as impression of the prepared area, temporary restorations, and laboratorial procedures
- Require more than one appointment [1,23].

Conclusion

Aesthetic treatment decisions should be based on prevailing clinical conditions and the patient preferences and anticipations, following the principles of maximum conservation of the tooth structure. The veneers are restorations restricted to the labial surface of aesthetically compromised anterior teeth, on areas visible during smile or conversation, keeping intact the proximal and lingual surfaces. The restoration can be performed directly with composite or indirectly with a ceramic or composite. The indirect technique requires the impression or scanning of the preparation and a provisional restoration. The cementation steps are critical to the quality of the treatment, and a careful procedure must be performed. The clinical success depends on durable bonding between the laminate and prepared and primed tooth substance. Whatever is the choice of veneering material, the adhesive resin cement, and surface pretreatment methods, it is very important for the dentist to gain confidence with the use of the chosen laminate treatment modality.

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