Republic of Iraq
Ministry of Higher Education and Scientific Research
University of Baghdad
College of Dentistry

Veneer

A Project Submitted to
the College of Dentistry, University of Baghdad, Department of conservative dentistry in partial fulfillment for the requirement to award the degree
B.D.S

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B.D.S., M.Sc,ph.D in Conservative Dentistry.

2022 A.D 1443 A.H

DECLARATION

This is to certify that the organization and the preparation of this had been made by graduate student **Abd-Alhameed Hassan Gillab** under my supervision in the College of Dentistry, University of Baghdad in partial fulfillment of the requirement for the 5th grade.

Signature:

Dr. Manhal Abdul-Rahman

The supervisor

DEDICATION

To my heart family who stand with me at every step and never let me alone till this moment of my life and have the most role in my success, they gave me the power to stay strong and never fall down.

To my father, I want to tell him that I did it, I promise him that I will make him proud of me, thank you for all you have done throughout my life, you raised me, protected me and taught me all you know.

To my all friends thank you for being by my side today and always. Finally, to my supervisor who encourage me to keep going on in my study life.

ACKNOWLEDGMENT

Thanks, Allah, for everything, for providing me with power and patience to perform this study. I would like to express grateful thanks to dean of College of Dentistry, University of Baghdad **Prof. Dr. Raghad A. Al-Hashimi**. My deep thanks to Scientific Assistant Dean **Prof. Dr. Ali Al-Bustani**, for supporting the undergraduate student. To my supervisor **Dr. Manhal Abdul-Rahman**, I would like to express gratitude to scientific care and to the spirit of high morality that encourage and advise me always to right way throughout this research Ask Allah to reward her the best reward. Great thanks to all members of conservative dentistry department for high ethics and for standing help. Thank everyone who helped me in the completion of the search for scientific truth. Finally, I would like to express grateful thanks to my lovely family, my wonderful parents, and my brothers, sister for everything.

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INTRODUCTION

Restorative aesthetic dentistry should be practiced as conservatively as possible. Currently, the use of adhesive technologies makes it possible to preserve as much tooth structure as is feasible while satisfying the patient's restorative needs and aesthetic desires. With indirect restorations, clinicians should choose a material and technique that allows the most conservative treatment; satisfies the patient's aesthetic, structural, and biologic requirements; and has the mechanical requirements to provide clinical durability.Based on their strength, longevity, conservative nature, biocompatibility, and aesthetics, veneers have been considered one of the most viable treatment modalities since their introduction in 1983.Aesthetic veneers in ceramic materials demonstrate excellent clinical performance and, as materials and techniques have evolved, veneers have become one of the most predictable, most aesthetic, and least invasive modalities of treatment. For this reason, both materials and techniques provide the dentist and patient an opportunity to enhance the patient's smile in a minimally invasive to virtually noninvasive way. Initially used to treat various kinds of tooth discoloration, porcelain laminate veneers have been increasingly replaced by more conservative therapeutic modalities, such as bleaching and enamel micro abrasion. However, this evolution has not led to a decrease in indications for veneers, as materials and techniques continue to be developed. Ceramic veneers are considered the ultimate option for a conservative aesthetic approach because they leave nearly all of the enamel intact before the veneer is placed. Since its introduction more than two decades ago etched ceramic veneer restoration has proven to be a durable and aesthetic modality of treatment. The clinical success that the technique has found can be attributed to great
attention to detail in a set of procedures, including planning the case, with the correct indication; conservative preparation of the teeth; proper selection of

ceramics to use; proper selection of the materials and methods of cementation; and proper planning for the ongoing maintenance of these restorations. Accordingly, this article discusses the aspects of ceramic laminate veneers restoration that involve materials, applications, and techniques, in order to address some concerns about newer trends, materials, and methods as they relate to the continued success of this modality of treatment (**Radz,2011) (Belser and Magne,1997**) (**Strassler, 2007) (Peumans and Van Meerbeek, 2007) (Calamia , 2000)**

1.Veneer Definition

A veneer is a layer of tooth-colored material that is applied to a tooth to restore localized or generalized defects and intrinsic discolorations Typically, veneers are made of directly applied composite, processed composite, porcelain, or pressed ceramic materials. Common indications for veneers include teeth with facial surfaces that are malformed, discolored, abraded, or eroded or have faulty restorations see figure1. Two types of esthetic veneers exist:

(1) partial veneers

(2) full veneers.

Figure 1: Full veneer

1.2 Indications

The classification by Magne and Belser **(Magne and Belser, 2002)**

1.typeI – teeth resistant to bleaching:

a) tetracycline discoloration.

b) No response to external or internal bleaching.

2.Type II – Major morphologic modifications:

a) Conoid teeth.

b) Diastema and interdental triangles to be closed.

c) Augmentation of incisal length and prominence .

3.Type III – Extensive restoration:

a) Extensive coronal fracture.

b) Extensive loss of enamel by erosion and wear.

c) Generalised congenital and acquired malformations

1.3 Contraindications

1. Full coverage restorations are preferred over veneers in case of insufficient coronal tooth structure. A fractured tooth, with more than one-third of loss of tooth structure, are a poor case for veneers **(Highton and Caputo, 1987).**
2. Actively erupting teeth should not be subjected for veneering.
3. Patients with parafunctional habits like bruxism should hardly receive veneers **(Highton and Caputo, 1987).**
4. Endodontically treated teeth are again not recommended for veneers as they present a poor receptive surface for bonding and full coverage restorations are indicated.

1.4 Advantages

- Conservative tooth preparation (only about 0.5 mm of facial reduction is needed) .
- Since tooth preparation is confined to the enamel layer. Local anesthesia is not usually required
- Excellent esthetics and color match
- Chemically inert, so resistance to fluid absorption
- Biocompatible in nature

- Good abrasion resistance. **(Garg and Nisha,2010)**

1.5 Disadvantages

- Fragile and brittle in nature
- Difficult to repair or modify after cementation
- More expensive than amalgam or composite
- Need special and expensive laboratory equipment
- Intraoral finishing and polishing is a time consuming procedure.
- Highly technique sensitive
- Needs precise tooth preparation **(Garg and Nisha,2010)**

Partial veneers are indicated for the restoration of localized defects or areas of intrinsic discoloration. Full veneers are indicated for the restoration of generalized defects or areas of intrinsic staining involving most of the facial surface of the tooth. Several important factors, including patient age, occlusion, tissue health, position and alignment of teeth, and oral hygiene, must be evaluated before pursuing full veneers as a treatment option. If full veneers are done, care must be taken to provide proper physiologic contours, particularly in the gingival area, to ensure good gingival health. severe gingival irritation exists around the over-contoured veneers; a purulent exudate is evident on probing the margins with an explorer. Full veneers can be accomplished by the direct or indirect technique. When only a few teeth are involved or when the entire facial surface is not faulty (i.e., partial veneers), directly applied composite veneers can be completed chairside in one appointment for the patient. Placing direct composite full veneers is time consuming and labor intensive. For cases involving young children or a single discolored tooth, or when the patient's time or money is limited, precluding a laboratory-fabricated veneer, the direct technique is a viable option. Indirect veneers require two appointments but typically offer three advantages over directly placed full veneers:

1. Indirectly fabricated veneers are much less sensitive to operator technique. Considerable artistic expertise and attention to detail are required to consistently achieve esthetically pleasing and physiologically sound direct veneers. Indirect veneers are made by a laboratory technician and are typically more esthetic.
2. If multiple teeth are to be veneered, indirect veneers usually can be placed much more expeditiously
3. Indirect veneers typically last much longer than do direct veneers, especially if they are made of porcelain or pressed ceramic.

Some controversy exists regarding the extent of tooth preparation that is necessary and the amount of coverage for both direct and indirectly fabricated veneers.Some operators prefer to etch the existing enamel and apply the veneer (direct or indirect type) to the entire existing facial surface without any tooth preparation. The perceived advantage of these “no prep” veneers is that little or no tooth structure is removed. Also, in the event of failure or if the patient does not like the veneer, it supposedly can be removed (being reversible), although in actuality, it is never easy to remove any bonded veneer without concomitant removal of some tooth structure. Several significant problems exist, however, with this approach.

1. To achieve an esthetic result, if the tooth is otherwise of normal contour, the facial surface of such a restoration will be over-contoured, appearing and feeling unnatural. This observation is true for both direct and indirect veneers. An over-contoured veneer frequently results in gingival irritation with accompanying hyperemia and bleeding caused by bulbous and impinging gingival contours.

2. With regard to direct veneers, the veneer is more likely to be dislodged when no tooth structure is removed before the etching and bonding procedures are done. If the veneer is lost, it can be replaced. The patient may live in constant fear, however, that it will happen again, possibly causing embarrassment.

The reversibility of no-prep veneers may seem desirable and appealing to patients from a psychological standpoint; however, few patients who elect to have veneers wish to return to the original condition. In addition, removing full veneers with no damage to the underlying unprepared tooth, as noted earlier, is exceedingly difficult, if not impossible. To achieve esthetically pleasing and physiologically sound results consistently, an intra-enamel preparation is usually indicated. The only exception is in cases in which the facial aspect of the tooth is significantly under-contoured because of severe abrasion or erosion. In these cases, mere roughening of the involved enamel and defining of the peripheral margins are indicated. Intra-enamel preparation (or the roughening of the surface in under-contoured areas) before placing a veneer is strongly recommended for the following reasons:

1. To provide space for bonding and veneering materials for maximal esthetics without over-contouring
2. To remove the outer, fluoride-rich layer of enamel that may be more resistant to acid-etching
3. To create a rough surface for improved bonding
4. To establish a definite finish line Establishing an intra-enamel preparation with a definite finish line is particularly important when placing indirectly fabricated veneers.

Accurate positioning and seating of an indirectly made veneer are enhanced significantly if an intraenamel preparation is present. Another controversy involves the location of the gingival margin of the veneer. Should it terminate short of the free gingival crest at the level of the gingival crest or apical of the gingival crest? The answer depends on the individual situation. If the defect or discoloration does not extend subgingivally, the margin of the veneer should not extend subgingivally.

The position of the gingival margin of any veneer is dictated by the extent of the defects or discoloration and the amount of tooth structure that is visible with maximum smiling. If a patient exhibits a high smile line that exposes the entire facial surface of the tooth and if defects like fluorosis stains are generalized, then the margin of the veneer must be positioned at the level of the crest of tissue to optimize esthetics. However, the only logical reason for extending the margin subgingivally is if the gingival area is carious or defective, warranting restoration, or if it involves significantly dark discoloration that presents a difficult esthetic problem. No restorative material is as good as normal tooth structure, and the gingival tissue is never as healthy when it is in contact with an artificial material. **(Ritter and Andre, 2017)**

1.6 Types of veneer preparation

I. Window preparation.

II. Butt-joint incisal preparation.

III. Incisal-lapping preparation.

I.window preparation: is recommended for most direct composite veneers. It is also frequently used in cases of indirectly fabricated veneers where the outline form of the canine is intact and the patient is canine guided. This intra-enamel preparation design preserves the functional lingual and incisal surfaces of maxillary anterior teeth, protecting the veneers from significant occlusal stress. This quality is of particular importance with direct composite veneers. A window preparation design also is recommended for indirectly fabricated porcelain veneers in patients who exhibit a canine-guided pattern of lateral guidance and in whom the maxillary canines are of normal contour with little incisal wear or notching. By using a window preparation, the functional surfaces are better preserved in enamel This design reduces the potential for accelerated wear of the opposing tooth that could result if the functional path involved porcelain on the lingual for most indirectly fabricated porcelain veneers, either a butt-joint incisal design or an incisal-lapping approach is used.

II. Butt-joint incisal design: is used routinely in cases where no defects exist along the lingual aspect of the incisal edge. It is the simplest design and is used to easily provide adequate reduction of the tooth to accommodate the needed strength of the porcelain veneer in this area of the preparation.

III. Incisal-lapping preparation is indicated when the tooth being veneered needs lengthening or when an incisal defect warrants restoration. The extent of the lapping onto the lingual surface is generally dictated by the extent of the lingual incisal defect or by the amount of faciolingual resistance form desired for reinforcement of the incisal edge and incisal surfaces, as with incisal butt-joint or incisal-lapping designs. **(Ritter and Andre, 2017)** See figure2

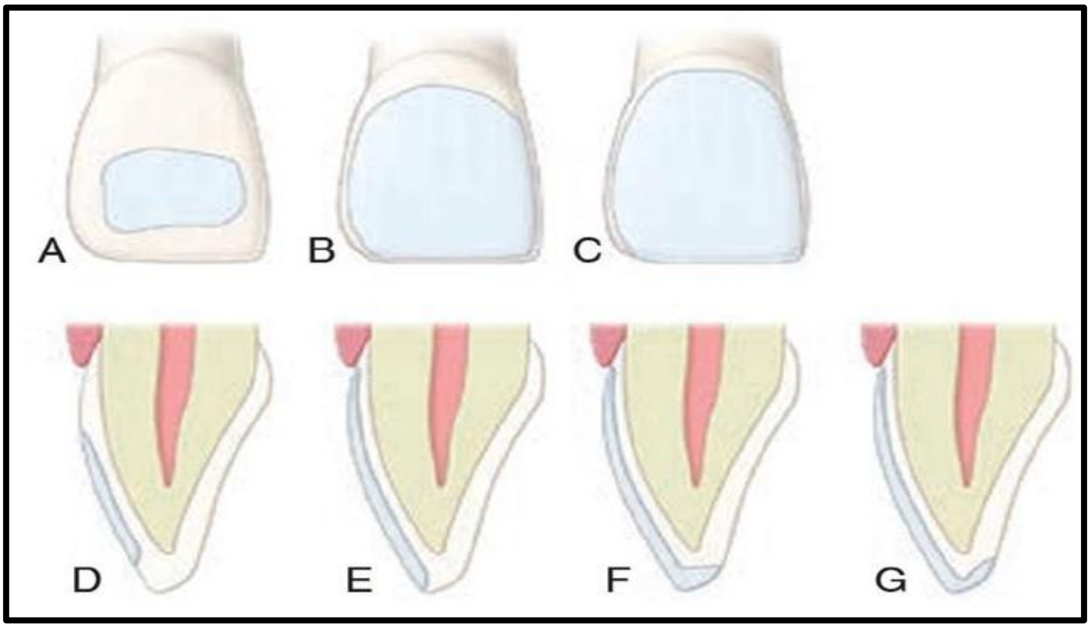

Figure 2: Four types of veneers. A, Facial view of partial veneer that does not extend subgingivally or involve the incisal angle.

B, Full veneer‹with window preparation design that extends to the gingival crest and terminates at the facio-incisal angle.

C, Full veneer with either a butt-jointincisal preparation design or an incisal-lapping preparation design extending subgingivally and including all of incisal surface. (Subgingival extension is indicated only for preparation of darkly stained teeth and is not considered routine.)

D-G, Cross-sections of the four types of veneers:

D, Partial veneer**.**

E, Full veneer with window preparation design**;**

F, Full veneer with butt-joint incisal preparation design**;**

G, Full veneer with incisal-lapping incisal preparation design

1.7 Types of veneers according to coverage area

1.7.1 Direct Partial Veneers

Small localized intrinsic discolorations or defects that are surrounded by healthy enamel are ideally treated with direct partial veneers Preliminary steps include cleaning, shade selection, and isolation with cotton rolls or rubber dam. Anesthesia usually is not required unless the defect is deep, extending into dentin on removal of the defective veneers, the localized white spots are evident. The clinician should use a coarse, elliptical or round diamond instrument with airwater coolant to remove the defect. The use of water-air spray is also imperative so that the tooth can be maintained in a hydrated state. If dehydration is allowed to occur, it can cause the appearance of other white spots which are artifacts and which will make defect assessment much more difficult.

After preparation, etching, and restoration of the defective areas. Usually, it is desirable to remove all of the discolored enamel in a pulpal direction. If the entire defect or stain is removed, a microfilled composite is recommended for restoring the preparation. Microfills are excellent “enamel replacement” materials because of their optical properties. If the tooth has been maintained in a hydrated state, the microfilled composite can be positioned on a trial basis to assess the accuracy of the shade prior to final restoration.

Nanofilled composites also are excellent material choices for this technique. If a residual lightly stained area or white spot remains in enamel, however, an intrinsically less translucent composite can be used, rather than extending the preparation into dentin to eliminate the defect. Most composites filled primarily with radiopaque fillers (e.g., barium glass) are more optically opaque with intrinsic masking qualities (in addition to being radiopaque). Use of these types of composites for the restoration of preparations with light, residual stains is most effective and conserves the tooth structure. In this example, all restorations are of a light-cured microfilled composite.

Figure 3: Direct partial veneer

1.7.2 Direct Full Veneers

Extensive enamel hypoplasia involving all maxillary anterior teeth was treated by placing direct full veneers in this case diastema also was present between the central incisors. The patient desired to have the hypoplasia and the diastema corrected; examination indicated a good prognosis. A direct technique was used with a light-cured microfilled composite. Placing direct full composite veneers is very time consuming. Although all six teeth can be restored at the same appointment, it may be less traumatic for the patient and the dentist if the veneers are placed in two appointments. In this example, the central incisors were completed during the first appointment, and the lateral incisors and canines were completed during the second appointment. After the teeth to receive the veneers are cleaned and a shade is selected, the area is isolated with cotton rolls and retraction cords. Both central incisors are prepared with a coarse, rounded-end diamond instrument. The window preparation typically is made to a depth roughly equivalent to half the thickness of the facial enamel, ranging from approximately 0.5 to 0.75 mm midfacially and tapering down to a depth of about 0.3 to 0.5 mm along the gingival margin, depending on the thickness of enamel A well-defined chamfer at the level of the gingival crest provides a definite preparation margin for subsequent finishing procedures. The margins are not extended subgingivally because these areas are not defective. The preparation for all veneer types (both direct and indirect) normally is terminated just facial to the proximal contact except in the case of a diastema

Figure 4: Full direct veneer

When interdental spaces exist, the preparations must be extended from the facial surfaces onto the mesial surfaces, terminating at the mesiolingual line angles.This lingual extension of the preparation allows for proper reestablishment of the entire proximal contour of the tooth in the final restoration. The incisal edges were not included in the preparations in this example because no discoloration was present. In addition, preservation of the incisal edges better protects the veneers from heavy functional forces, as noted earlier for window preparations. The teeth to be treated should be restored one at a time. After the etching, rinsing, and drying procedures, the dentist applies and polymerizes the resinbonding agent. The dentist places the composite on the tooth in increments, especially along the gingival margin, to reduce the effects of polymerization shrinkage. The composite is placed in slight excess to allow some freedom in contouring. It is helpful to inspect the facial surface from an incisal view with a mirror to evaluate the contour before polymerization. After the first veneer is finished, the second tooth is restored in a similar manner **(Ritter and Andre, 2017)**

1.7.3 Indirect Veneer

Many dentists find that the preparation, placement, and finishing of several direct veneers at one time is too difficult, fatiguing, and time consuming. Some patients become uncomfortable and restless during long appointments. In addition, veneer shades and contours can be better controlled when made outside of the mouth on a cast. For these reasons, indirect veneer techniques are usually preferable. Indirect veneers are primarily made of

a. **processed composite.**
b. **feldspathic porcelain.**
c. **cast or pressed ceramic.**

Because of superior strength, durability, and conservation of the tooth structure, feldspathic porcelain bonded to intra-enamel preparations has historically been the preferred approach for indirect veneering techniques. See figure 5

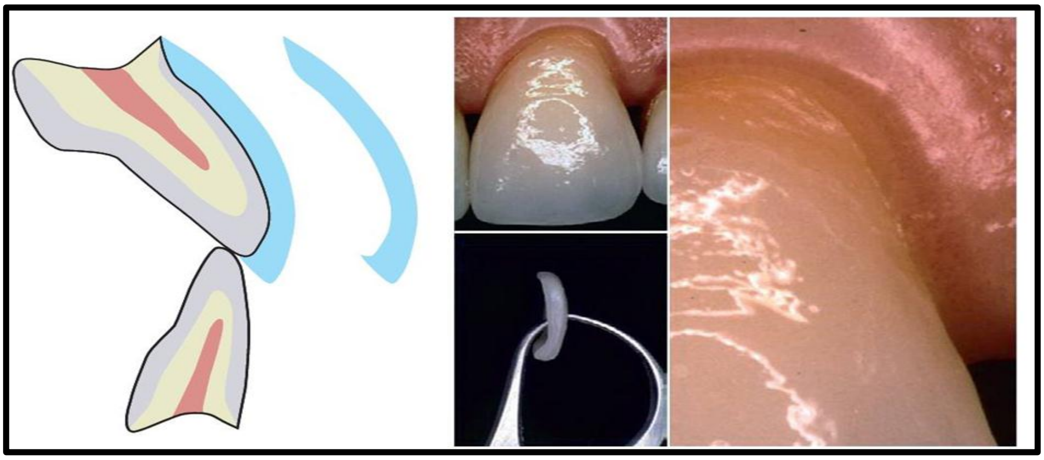

Figure 5: Very thin porcelain veneer permit translucence

Used by dentists. Some pressed ceramic veneering materials offer comparable esthetic qualities but may require a deeper tooth preparation that is often located in dentin. Studies show that bond strengths to dentin decline over time and that porcelain veneers placed in intra-enamel preparations offer the best long-term results. **(Dumfahrt and Schaffer ,2000) (Friedman,1998)** However, newer, currently available pressed or castable ceramics are capable of being fabricated to much thinner dimensions, making them viable options for indirect fabrication as well. Although two appointments are required for indirect veneers, chair time is reduced because much of the work has been done in the laboratory. Excellent results can be obtained when proper clinical evaluation and careful operating procedures are followed. Indirect veneers are attached to the enamel by acid etching and bonding with light-cured resin cement**.**

1.7.4 Etched Porcelain Veneers

The preferred type of indirect veneer is the etched porcelain (i.e., feldspathic) veneer. Porcelain veneers etched with hydrofluoric acid are capable of achieving high bond strengths to the etched enamel via a resin-bonding medium (**Calamia,1983**) (**Stangel and Nathanson,1987**). In addition to the high bond strengths, etched porcelain veneers are highly esthetic, stain resistant, and periodontally compatible. The incidence of cohesive fracture for etched porcelain veneers is also very low.36 However, as noted earlier, the key to the long-term success with etched porcelain veneers is the use of a conservative intra-enamel preparation. Preparations into dentin should be avoided because virtually all problems associated with etched porcelain veneers (debonding, accelerated marginal staining, tooth sensitivity, etc.) occur when excessive amounts of dentin are exposed in the veneer preparation

1.7.5 No-Prep Veneers

As noted earlier one approach being used for indirect veneers is to place them on teeth with no tooth preparation. Although this “no prep” approach may at first appear desirable, it can later cause problems if proper case selection is not done. No-prep veneers are best used when teeth are inherently under-contoured, when interdental spaces or open incisal embrasures are present, or when both conditions exist. However, no-prep veneers can be problematic. First, no-prep veneers are inherently made thinner and, consequently, are more prone to fracture, especially during the try-in phase. Second, for indirect no-prep veneers, interproximal areas are difficult to access for proper finishing. And third, as noted earlier, if case selection is not done properly and the teeth are already of normal contour, the resulting veneers inevitably will be over-contoured. Veneers that are over-contoured are not generally esthetic and often can result in impingement of gingival tissue, as noted earlier. For these reasons, it is advisable, in most cases, to use a conservative, intra-enamel preparation for the use of indirect veneers, **(Ritter and Andre V,2017)**

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1.1 Veneer preparation

1.2.1 Facial Preparation

Facial Convexity Today restorative dentistry means the production of biocompatible restorations that exhibit a very natural appearance. If tooth preparation is not properly preformed it is difficult, if not impossible, to copy the natural dentition with the manipulation of light that today's ceramics are capable of.**(Vence,2000)** During the preparation of the buccal plane the facial of the incisors, which are convex, should be addressed in the incisal, middle 1/3rd and cervical aspects.3 Different characteristics are apparent when viewed from the mesial and distal aspects**(Schwartz, 2000)**.The maxillary central incisor's vertical mesial line angle profiles are basically the same, and the cervical, middle and incisal portions of the central display proportions of 1 to 2 to 3 respectively, when viewed from the mesial prospective. However, individual variations of the vertical distal line angle of the maxillary centrals exist. The variations in length (according to each developmental lobe) of the cervical, middle and incisal aspects of the buccal plane add diversity and character to the anterior teeth. Preparation according to the length of these three aspects of the buccal surface enables the dentist to preserve character in the veneer restoration.

1.2.2 Depth Cutters

Accurate judgment of size, depth and angle is required in the practice of restorative dentistry. Most assessments are made simply by visual examination, and are therefore often subjective. Two different-sized depth cutters control the depth of the facial tooth preparation. They enable the dentist to guide, visualize and quantify enamel reduction. Due to the rounded tip, margins can be plotted if deemed necessary. When the color changes are two shades or less, as in more than 90% of the cases, 0.3 mm and 0.5 mm depth cutters are used. Without a depth guide, it can be dangerous to gauge reduction in enamel depth between 0.3

mm and 0.5 mm.5 However, if the pre-operative evaluation is not done properly, these depth cutters can be very destructive in terms of unnecessary sound tooth structure loss, and thus weaken the intact tooth structure.

1.2.3 Enamel thickness

Enamel has different thicknesses at the gingival, middle and incisal 1/3rds of the facial surface of the tooth. They can be 0.3-0.5 mm at the facial gingival third, upto 0.6-1.0 mm at the middle third and 1.0-2.1 mm at the incisal third.94 This indicates that having these variables both on the surface texture (i.e. convexity) and using a special diamond instrument at different angles, designed specifically for the task, can better facilitate enamel thickness tooth preparation. Diamond depth cutters (originaly designed by Dr. Tuoti) have different cutting depths within themselves, relative to the enamel thicknesses of the facial surface of the incisors. The self-limiting depth cutter is designed so that it can cut to a depth limited to the radius of the wheel. The wheels are limited to penetrating the enamel until the shaft is flush with the tooth surface. Course diamond wheels with different diameters mounted on a 1 mm-diameter noncutting shaft create the correct depth - orientation grooves on the facial surface of the incisors. Once again. See figure7

Figure 6: diamond bur for veneer preparation created by dr.touti

1.2.3.1 Technique of enamel preparation

At the beginning of each preparation horizontal grooves are traced. Labial surface striations are apart from the margin. Especially in the case of the lower premolars and the canines, the three striations are very rarely allowed on the natural curve of the facial surface. When the bur is held parallel to the surface of the tooth, only the middle section of the three-tiered deep cutting bur penetrates into its entire depth, which is due to the convex labial surface of the tooth. Under-preparation of the cervical or incisal area can be avoided by positioning the bur at three different angulations to ensure its penetration.96To provide a natural healthy look for the incisor that mimics its true convex nature, a uniform removal of substrate is essential and can be achieved through the use of the bur, keeping it at three different angles. Otherwise, one plane facial reduction may come too close to the pulp.When the diamond is swept in the mesiodistal direction, a gentle convex surface in the gingival and incisal 1/3rds is obtained. The facial reduction is complete once the paint becomes invisible on the facial side, and to complete the final reduction, the horizontal labial depth grooves are connected. See figure8

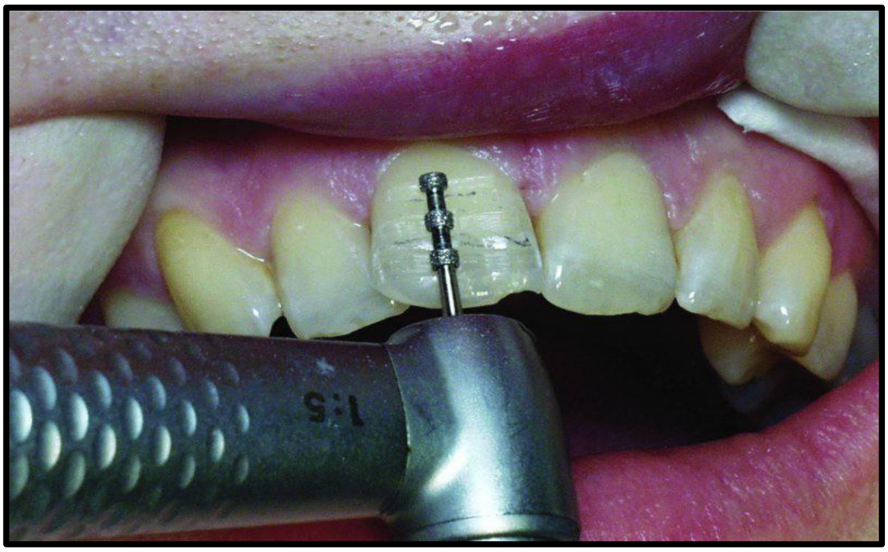

Figure 7: Veneer depth cut on central incisor

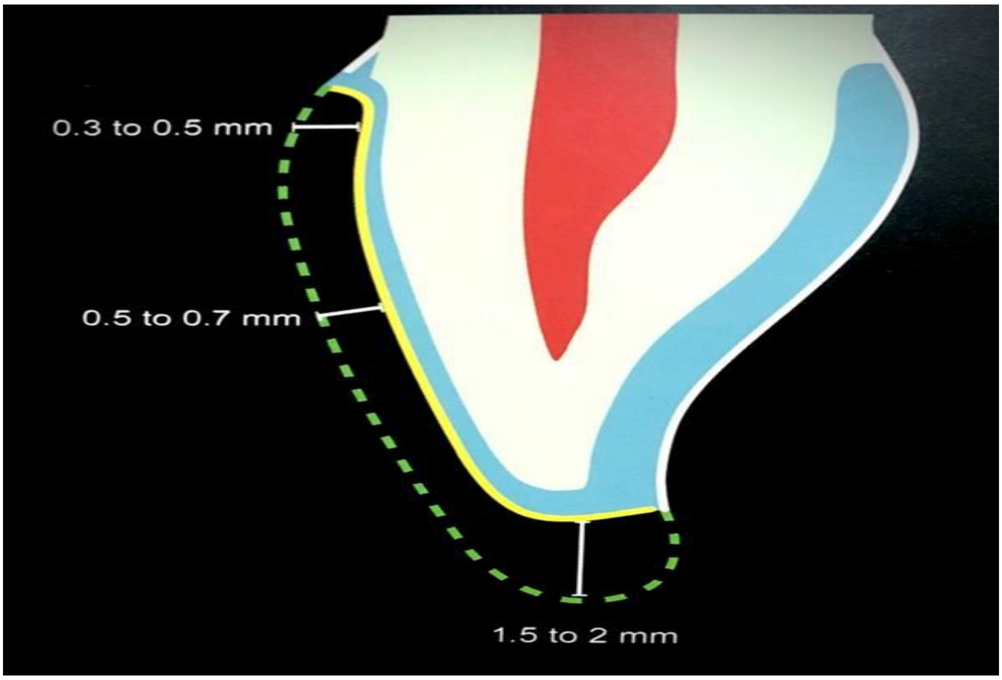

Figure 8: Enamel thickness**.**

1.2.3.2 Incisal 1/3 preparation

Preparing the Incisal 1/3rd A common error is to place the incisal 1/3rd too far labially in the final restoration.98 This is frequently due to insufficient tooth reduction. The preparation must reproduce the natural convexity of a maxillary central incisor and provide for a minimum reduction thickness of 0.7 at the junction of the middle and incisal thirds of the tooth.99 - 100 Insufficient tooth reduction, in terms of leaving a sharp line angle and not rounding off the incisal labial area, is the leading cause of an over tapered preparation, or produces opaque show through, or over contouring of the incisal third of the restoration. This will not only influence the external facial form of the tooth, but the light reflection as well. Light reflects off the tooth and travels through it at the incisal. If the edge has a rounded surface at the incisal-labial, that reflected light is being diffused and yields an ideal transition of the shade from incisal color to body color.

1.2.4 Silicone Index

Using a silicone index is a controlled way of prepping the remaining portion of this side and can frequently determine sufficient tissue reduction during the preparation of the tooth. **(Touati and Miara,1999)** This can be prepared by the dental technician from the initial wax-up model. When viewed from the incisal preparation depths, cutting the silicone index into horizontal slides can follow different vertical levels of the facial surface. The middle or gingival 1/3rd can be visualized when the slides are moved once the incisal 1/3rd has been checked. The desired homogenous depth can be completed in this accurate way

1.2.5 Gingival Preparation

The fabrication of the PLV is directly affected by the placement of the finishing line. Smooth margins that are fully exposed and readily cleansable generally provide the best results. (**Eissmann and Radke, 1999)** Consequently, the essential key here is for the dentist to place the finishing line where the margins of the restoration can be kept clean by the patient and properly finished by the dentist. In addition, finish lines must be placed so that they can be duplicated by the impression, without tearing or deforming the impression when it is removed past them. Unlike circumferential preparations, and like the metal ceramic crowns that have their margins buried into the sulcus, the thin porcelain and the resulting chameleon effect on the cervical margin enables the dentist to place the gingival margins of the PLV supragingivally. With no cement line or metal margin visible, the porcelain blends in with the underlying composite resin in a harmonious finish. Whenever possible, the finish lines should be placed in the enamel following the contour of the soft tissue from mesioproximal to distoproximal**. (Kourkouta and Walsh,1994)** demonstrated that after the placement of the PLVs there was noticeable plaque index reduction and plaque bacteria vitality. For those patients who have problems with oral hygiene, PLVs are the restorations that cause the least problems**. (Magne and Perroud, 2000)** In comparison to gold, resin or hard tooth structures, dental porcelain is less likely to accumulate bacterial plaque and therefore the periodontal response is favorable. **(Chan and Weber,1986) (Koidis and Schroeder,2000)**

1.2.5.1 Supragingival Margins

Placement of the gingival margin supragingivally or coronally frees the gingival margin. This has many advantages such as:

- eliminating the chances of injury to the gingival tissue,
- cutting down on the risks of undue exposure of the dentin in the cervical region
- obtaining crisp clear margins
- impressions are easier to make with supragingival preparations compared to subgingival preparations.
- It also increases the likelihood that the restoration will end on enamel and this increased area of enamel is extremely important for stronger adhesion and less microleakage in the future.

1.2.5.2 Subgingival Margins

The reaction of the gingival tissues largely depends on the cervical extension of the restoration in regard to the location to the gingival margin**. (Pippin and Mixon, 1995)** Generally speaking, the major etiological factor in periodontitis is the subgingival placement of a restoration. (**Waerhaug,1996) (Reeves,1991)** On the other hand, it is reported that PLVs typically show less gingival reaction than metal ceramic restorations as the extension comes closer to or below the gingival margin. In a majority of the cases, the subgingival margin preparation of the intracrevicular margins should be placed at about half the width of the crevice depth. To create a buffer zone between the epithelial attachment and the bur, it is best to place the margins half way in the crevice to leave enough space for the gingival cord placement Sometimes the preparation may be deeper than the desired depth **(Silness, 1970) (Newcomb, 1982)** The deeper the restoration margin resides in the gingival sulcus, the greater the chance of inflammatory response and that such tissues can bleed upon probing. **(Lang and Kaarup-Hansen, 1988)**

1.2.6 Chamfer Preparation

It is almost impossible to finish an accurately fitting PLV without being over contoured over a knife-edge preparation at the cervical area. Therefore, irrespective of its placement (sub or supragingivally), a chamfer is preferred for all the gingival margins. A study was conducted using finite element analysis to gauge the total strain on porcelain stresses on 90- and 120- degree shoulders and chamfer preparations, with the chamfer showing the most resilience. **(Bichacho ,1996)** In comparison with the 90-degree shoulder, the chamfer finish preserves more natural tooth. Owing to the gradual color transition between restoration and tooth substrate, thereby avoiding the sudden delineation between tooth and crown, it is also a better option esthetically. In order to obtain a very distinct and visible finish line, removal of the serrated, overhanging enamel prisms is essential. **(Ahmad,2001)** To avoid periodontal inflammatory responses and future gingival recession, improving gingival architecture, survey lines and points of concavity with a chamfered margin while carefully controlling the anatomical contours in the cervical third, is of the utmost importance. The rounded tip of the fissure diamond bur will enable the cervical margin to be initiated slightly above the gingival level.

1.2.7 Proximal Preparation

Prior to the facial preparation and the creation of the gingival margin, the preparation for the proximal surfaces must be thoroughly planned. The aim must be to place the margins beyond the visible area and to preserve the contact area. Esthetics should be carefully considered when placing the proximal "stop-line", providing that the teeth are free of proximal restorations. It is very important to go beyond the visible area that can be viewed from the front or side, especially when tooth color is very different from that of the laminate veneers. Destroying the contact areas in order to create the margins is unnecessary, but, in some cases, the preparation margin may be extended further in a lingual direction. The margin can be drawn back even more in the lingual direction if the natural contact area has already been lost due to a diastema, restoring a broken angle or to encompass a proximal composite. **(Touati and Miara, 2000)**

1.2.8 Incisal Preparation

There are two basic techniques for the placement of the incisal finish line.

The first terminates the prepared facial surface at the incisal edge. There is no incisal reduction or prep of the lingual surface and it can be in the form of a window or intra-enamel preparation or the feathered incisal preparation.

the second technique, the incisal edge is slightly reduced and the porcelain overlaps the incisal edge, terminating on the lingual surface. In a retrospective clinical evaluation, the two techniques were used equally and both provided clinically acceptable results.

After two and a half years of clinical functioning, porcelain veneers have shown no relation between survival rates due to incisal preparation design (no incisal overlap versus incisal overlap). **(Hui and Williams,1991)** Many different techniques—such as the overlapped incisal edge tooth preparation, the feathered incisal edge tooth preparation, the incisal 0.5-1 mm bevel preparation and the intraenamel or "window" tooth preparation in which 1.0mm of incisal edge is preserved—are presently being used. **(Clyde and Gilmore,1988)**. To comfort the patient this ledge must be thinned down to the lingual contour of the tooth with a rotary instrument, leaving the remaining 0.1 or 0.2 mm thick porcelain prone to cracks in the near future. Having this in mind, it is always better to keep the distance from the tip of the prepared incisal edge to the edge of the palatinal wrap around shorter than the distance between the prepared tip of the tooth to the expected incisal edge of the PLV. A palatally extended preparation should make use of a round-end tapered diamond that will make it easier to create the lingual finish line. Its end should form a slight chamfer, 0.5 mm deep with the instrument held parallel to the lingual surface. The finish line should preferably be about one-fourth the way down the lingual surface about 1.0mm from the centric contacts while connecting two proximal finish lines. Care should be given not to locate this finishing line on the palatal concavity. The creation of the lingual finish line often produces a notch at the mesial and distal incisal corners. **(Shillingburg and Hobo,1992)** These corners are often not taken into consideration and left sharp. This kind of a preparation will cause a lot of problems during impression making, try-in and bonding, therefore weakening the bonding strength of the porcelain. Once the palatinal finishing line is placed, these sharp mesial and distal corners should be gently rounded as in interproximal and incisal overlap which will ease the placement of the final restoration. They will not only be stable at the time of insertion, but an improved esthetic definition of the PLVs will be obtained in the incisal zone.

1.3 Mock-up

Additive wax-ups, silicon guides and corresponding diagnostic templates are very helpful in increasing the survival rate of restorations and patient satisfaction. **(Magne and Douglas, 1995)** To get a better idea instantly of what the eventual outcome will be, utilization of the composite mock-up is wonderful as an aid. **(Miller, 2000)** The neighboring tissues or teeth provide three dimensional information that is necessary to give the restoration the correct volume and shape. A diagnostic "composite mock-up" which is the direct application of composite without surface preparation that perches itself on the teeth, is indicated when such elements are missing, or when an alteration of tooth forms is necessary. **(Dietschi, 1995)** A silicone key makes the final fix of the situation once it is programmed. **(Vanini, 1996)** From the preparation to the PLV build-up and restoration finishing, the clinician is guided by these spatial references. The restorative steps will be facilitated by the visual inspection of the frontal, lateral and incisal planes. (**Roulet and Degrange ,2000)**

1.3.1 Technique of mock-up construction

Depending on the difficulty of the case, it takes from 5 to 20 minutes to prepare the new smile design with composite mock-ups for the whole upper arch. The easiest way of doing the mockup is with the freehand carving method. **(Dietschi ,1995)** The composite is rolled between the fingers and applied over the dried tooth structure. It is shaped with the help of the fingers and special hand carving instruments and then light cured. The teeth can be lengthened or protruded, or the color can be altered for the patient to visualize. After placing the composite mock-up on the tooth, if any part is over exaggerated (in other words, if too much composite is applied and polymerized), it can be corrected with the help of a fissure diamond bur. However, careful attention should be given not to touch the intact tooth structure while doing so. Leaving a scratched enamel surface will be unfortunate if the patient does not accept the treatment.

1.3.2 Material used for mock-up construction

I.composite resin: characterized by the transfer of the aesthetic rehabilitation planning directly into the patient’s mouth with light-cured composite resin. Typically carried out with enamel resins due to its excellent polishability and immediate mimetism using ceramics, applied in a single layer over each tooth without any acid etching, distributing the resin in a cervicoincisal and mesial-distal direction, and shaping the tooth as established by the planning, always to be based on the prescribed aesthetic principles. Despite the imperative necessity to manipulate the composite resin with dexterity and of offering an idealized morphology which includes application, finishing and polishing, this technique saves time between appointments**. (Magne and Belser,2004)**

II.bis-acrylic resin: where the aesthetic rehabilitation planning is transferred to the patient's mouth with bis-acrylic resin. Despite its good finishing and polishing characteristics, bis-acrylic resins are monochromatic and may cause great estrangement to the patient with respect to the immediate result. Therefore, it is recommended to carry out a wax-up that offers not only the ideal dimensions, but a maximum of morphological and surface texture features. In this manner, the reflection of light is controlled, so that what will be valued is its highlighted idealized dental morphology.

III.acrylic resin: differs from the mock-up with bis-acrylic resin due to the rigidity of the acrylic resin mock-up, fabricated in the laboratory. Despite its excellent polychromatic property, it is possible to be applied and exhibit an excellent finishing and polishing, the high cost must be taken into consideration, except for cases of anticipated periodontal surgery, in which this technique is preferable. See figure 6 **(Decurcio and Cardoso et al, 2012)**

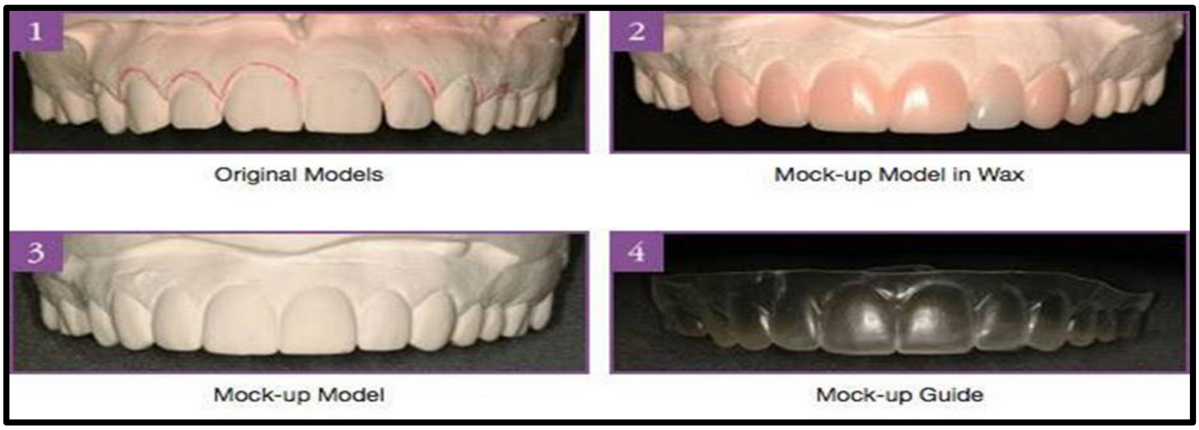

Figure 10: Mock-up models.

1.3.3 Porcelain Laminate Veneers versus Composite Restorations

It is possible to use composite restorations instead of porcelain laminate veneers to cover up tooth discolorations or unesthetic forms. However, the longevity of composites is questionable as they are susceptible to discoloration, marginal fractures and wear. Consequently, any esthetic result requiring long-term durability will be compromised **(Behend ,1982)' (Gardner, 1982**) while porcelain veneers are superior in esthetic quality and longevity. The biocompatibility and nonporous surface of the porcelain that prevents plaque adherence has increased its popularity and usage. **(Goldberg,1990)** Fur thermore, the applicability of the supragingival preparation technique, used in most veneer restorations, ensures excellent periodontal health. As a result, the porcelain laminate veneers have an important role as a solution to both functional and esthetic challenges.

1.4 Shade guides

Although the subjectivity of the visual observation method is proven in several studies, to visually compare the natural tooth with artificial shade guide is still the primary means of shade selection used in Dentistry. The first shade guide, with 60 chromatic samples, was created by Clark in 1930.Since then, several studies have been performed to optimize its clinical application, but without significant changes.Currently, Vitapan Classical® (VC - Vita Zahnfabrik, Bad Säckingen, Germany) and 3D-Master Vita® (V3DM – Vita Zahnfabrik, Bad Säckingen, Germany) the most popular chromatic scales are consideration . This shade guide has its chromatic tabs in four shades groups: A (brown), B (yellow), C (gray) and D (red). See figures

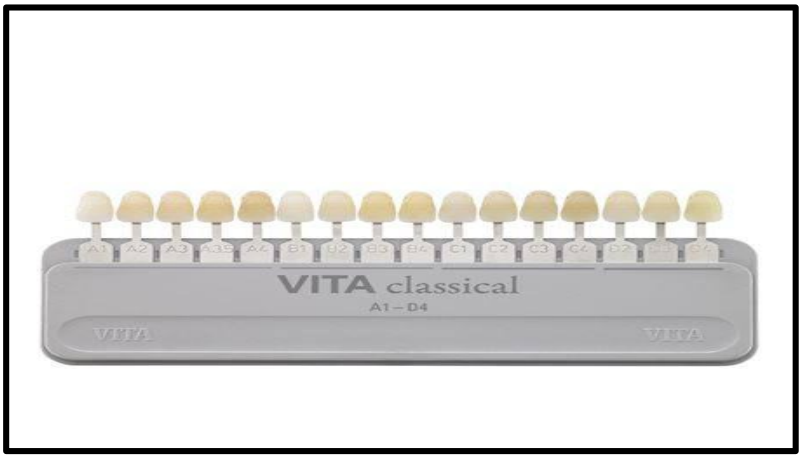

Figure 11: Classical vita shade guide

Figure 12: 3D master shade guide

1.4.1 Instrument shade evaluation

In the instrumental shade matching, the devices carry out the observation and registration of the shade mathematically, providing reliability to the method**. (Chu and Tarnow,2001) (Douglas,1997) (Goldstein,1994)**. This can be achieved by the use of spectrophotometers, colorimeters and digital computer analysis. Spectrophotometers are devices used to measure the color of an object by their reflected wavelengths

Figure 13: shade selection device

1.4.2 Shade selection technique

The excellence of the optical properties associated to extremely conservative preparations made ceramic veneers a more popular treatment alternative. The color of treatments carried out with ceramic veneers is a result of viewing the light interaction with the ceramic veneer, with resin cement and the supporting substrate which may be formed by dental tissue and/or restorative material. When performing planning of these restorations, one must consider the primary chromatic influence of the substrate. Therefore, a big difference between the initial color of the substrate and the desired final color is a great restorative challenge. So it is up to

- The ceramic veneer
- The resin cement the roles of neutralizing the color of the substrate and determining the final color of the restoration

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. In addition to vary according to the thickness, the color of the veneers may also vary according to the manufacturer, chemical composition, particle size and mode of fabrication. (**Heffernan and Aquilini, 2002) (Barizon and Bergeron ,2014)** Resin cements, in turn, are available in different shades and are critical to the success of restoration. Unfortunately, there are various systems of resin cements that have different characteristics of color and translucency for their respective shade tabs. Thus, it is strongly recommended to know the possibilities and limitations of the resin cement for a successful aesthetic treatment. The shade selection protocol differs according to the type of restoration to be fabricated. **(Stevenson and Ibbetson,2014) (Dozic and Tsagkari, 2010)** During the evaluation of tooth shade the following characteristics should be identified and replicated in descending order of importance:

- shape
- topography and surface texture,
- value
- translucency
- chroma

1.5 Types of porcelain laminate veneers

Ceramic restoration have become popular not only because of patient demand for esthetic, durable restorative materials but also because of improvements in materials, fabrication techniques, adhesives, and resin-based cements. Among the ceramic materials used are feldspathic porcelain, leucite-reinforced pressed ceramics, lithium disilicate, and various types of machinable (milled) ceramics designed for use with either chairside or laboratory CAD/ CAM systems**. (Giordano and McLaren, 2010)**

1.5.1 Feldspathic Porcelain

Dental porcelains are partially crystalline minerals (feldspar, silica, alumina) dispersed in a glass matrix. **(Giordano and McLaren,2010)** Porcelain restorations are made from finely ground ceramic powders that are mixed with distilled water or a special liquid, shaped into the desired form, and then fired and fused together to form a translucent material that looks like tooth structure. Currently, some ceramic inlays and onlays are fabricated in the dental laboratory by firing dental porcelains on refractory dies, but more are fabricated by pressing or milling methods, which are described later.:

- After tooth preparation, an impression is made, and a diestone master working cast is poured.
- The die is duplicated and poured with a refractory investment capable of withstanding porcelain firing temperatures. The duplication method must result in the master die and the refractory die being accurately interchangeable.
- Porcelain is added into the preparation area of the refractory die and fired in an oven. Multiple increments and firings are necessary to compensate for sintering shrinkage. N
- The ceramic restoration is recovered from the refractory die, cleaned of all investment, and seated on the master die and working cast for final adjustments and finishing.

1.5.2 Pressed Glass-Ceramics

Over 40 years ago, it was discovered that certain glasses could be modified with nucleating agents and, on heat treatment, be changed into ceramics with organized crystalline forms. Such “glass-ceramics” were stronger, had a higher melting point than noncrystalline glass, and had variable coefficients of thermal expansion. **(MacCulloch, 2007)** At first, these glass-ceramics were developed primarily for cookware and other heat-resistant products. However, in 1984, the glass-ceramic material Dicor was patented and became a popular ceramic for dental restorations. A major disadvantage of Dicor was its translucency, which necessitated external application of all shading. Dicor restorations were made using a lost-wax, centrifugal casting process. Newer leucite-reinforced glass-ceramic systems also use the lost-wax method, but the material is heated to a high temperature and pneumatically pressed, rather than centrifuged, into a mold. Although some studies indicate that hot pressed ceramics are not substantially stronger than fired feldspathic porcelains, they do provide better clinical service. **(Krämer and Taschner, 2008) (Krämer and Frankenberger, 2006) (Friedman, 1998) (Galiatsatos and Bergou, 2008)** The fabrication steps for one type of leucite-reinforced pressed ceramic restoration (IPS Empress) are summarized as follows:

1. After tooth preparation, an impression is made, and a working cast is poured in die-stone. A wax pattern of the restoration is made using conventional techniques
2. After spruing, investing, and wax pattern burnout, a shaded ceramic ingot and aluminum oxide plunger are placed into a special furnace. The shade and opacity of the selected ingot are based on the information provided by the clinician, specifically the desired shade of the final restoration and the shade of the prepared tooth.
3. At approximately 2012°F (1100°C), the ceramic ingot becomes plastic and is slowly pressed into the mold by an automated mechanism.
4. After being separated from the mold, the restoration is seated on the master die and working cast for final adjustments and finishing.
5. To reproduce the tooth shade accurately, a heavily pigmented surface stain is typically applied. The ceramic ingots are relatively translucent and available in a variety of shades, so staining for hot pressed ceramic restorations is typically minimal.

The advantages of leucite-reinforced pressed ceramics are their

(1) similarity to traditional “wax-up” processes

(2) excellent marginal fit,

(3) moderately high strength,

(4) surface hardness similar to that of enamel.

(Garvie and Nicholson, 1972) (Garvie and Hannink, 1975) Although pressed ceramic inlays and onlays are stronger than porcelain made on refractory dies, they are still somewhat fragile during try-in and must be bonded rather than conventionally cemented. **(Frankenberger and Taschner, 2008) (Galiatsatos and Bergou,2008) (Krämer and Taschner, 2008) (Krämer and Frankenberger, 2006) (Fradeani and Aquilano,1997)**.

1.5.3 Computer aided design/Computer aided manufacturing (CAD/CAM)

In comparison to all the other systems, the CAD/CAM or copy-milling techniques create a mean interfacial gap between the actual tooth structure and the restoration that is considerably wider than that of the other systems. This technology for metal-free restorations has become increasingly popular and reliable. In the last few years, several systems have shown that CAD/CAM-produced restorations are accurate enough to be used in the modern clinic. Different material compositions have been used. Aluminum reinforced matrix, zirconium and leucite ceramics were the most frequently used materials in the past. Some CAD/CAM systems have been used in the dental clinic (Cerec). Next-generation CAD/CAM units are being introduced, and will be able to prepare any kind of geometry; the indications for which they can be used are virtually limitless. Owing to the large size of this unit, access to the equipment is generally scanning or through the impression or die. A specialist will feed the clinical information into the software with all the related details concerning the preparation parameters. Centers will be set up so that all the necessary information about each case can be collected, produced and distributed. The results are perfectly fitting restorations, of exactly 5 microns. Outstanding results can be expected. These new materials, which are colored and translucent, will join compatible layering ceramic to conclude the restoration. This technique is very promising as it excludes the human fault rate with the production of a core or frame. On the other hand, it gives technicians the chance to concentrate their creativity totally on the build-up. (**Dalloca and Demolli, 1994) (Isenberg and Essig**, **1992)**

Advantages

1. High esthetic
2. Quick
3. Very large indications
4. Safe

Disadvantages

1. Units are expensive

Figure14: Intraoral scanner for CAD/CAM

1.7 Material selection for CAD\CAM veneer

Full contour restorations such as inlays, onlays, crowns, and veneers may be fabricated from various blocks of materials. In general, these blocks are fabricated from starting powders that are mixed with a binder and then pressed into a mold. The binder helps hold the powder together so that the shape is maintained after pressing. Then, the blocks are transferred to a furnace to remove the binder and sinter to full density. Restorations milled from blocks tend to have improved density and mechanical properties as compared with powder/liquid or pressed restorations due to the standardized manufacturing process **(Giordano and McLaren, 2010)**. A number of feldspathic porcelain (eg, Vita Mark II), leucite-reinforced porcelain (IPS Empress CAD, Ivoclar Vivadent), and lithium-disilicate (IPS e.max, Ivoclar Vivadent) blocks are available for use with the CEREC AC (Sirona) and E4D Dentist (D4D Technologies) systems (**Fasbinder, 2010**).

1.7.1 Glass/Crystal

The original block for the CEREC system was created as collaboration between Dr. Werner Mörmann and the Vita Corporation. The first blocks were created out of feldspathic porcelain and called the Vita Mark I blocks. These eventually evolved into the current generation of blocks (Vita Mark I). Available since 1991, the Vita Mark Il blocks are considered one of the most abrasion-resistant dental ceramics. Clinical studies have shown a survival rate of approximately 95 percent after 10 years The blocks are fabricated from feldspar porcelain particles embedded in a glass matrix and have a flexural strength of approximately 150 MPa (**Vitablocs and Mark, 2012**) Due to the small particle size in the material, the potential for wear on the opposing dentition is minimized. Ideal for inlays, onlays, crowns and veneers, the material can be glazed in a standard oven using low-fusing porcelain. While the strength of the material has shown to be sufficient for single-unit restorations, it's not a strong enough blocks for multi-unit fixed bridges **(Maclaren and Puri, 2013)**

1.7.2 Glass/Leucite

Glass/leucite materials include Empress CAD (Ivoclar Vivadent) which is a lucite glass-ceramic of the Si02-A1203-K20 materials system with approximately45% leucite crystals ranging from 5 to 10 um in size (**Ivoclar Vivadent, 2011**). The lucite (KAISi206) crystals increase the material's strength and slow down or deflect crack propagation, while the crystalline phase absorbs fracture energy. According to Giordano, this leucite-reinforced ceramic material has properties of strength and surface
characterization similar to those found in Vitablocs Mark I **(Giordano**, **2006) Giordano and McLaren ‹2010)** The Empress CAD blocks exhibit a flexural strength of approximately 160 MPa, which is similar to the Vita Mark I blocks. Able to be polished as well as glazed in an oven, the recommended indications are anterior crowns and veneers, and inlays, onlays and crowns in the posterior. However similar to Mark IL, the authors' recommendation is that the material be limited in use in esthetic anterior areas with low occlusal stress, such as veneers and crowns in the premolar and anterior region (**Maclaren and Puri, 2013)**

1.7.3 lithium disilicate

IPS e.max CAD (Ivoclar Vivadent) is a lithium disilicate glass-ceramic for CAD/CAM applications. The blocks are produced by massive casting of transparent glass ingots. A continuous manufacturing process based on glass technology (that is, pressure-casting) is utilized to prevent the formation of defects (pores, accumulation of pigments‹ and so forth) in the bulk of the ingot. Partial crystallization ensures that the blocks can be processed in a crystalline intermediate phase, which enables fast machining with CAD/CAM systems. The partial crystallization process leads to a formation of lithium metasilicate

(Li2Si03) crystals, which are responsible for the material's optimal processing properties, edge stability, and relatively high strength **(Ivoclar Vivadent, 2011**). After the milling procedure, the restorations are tempered and lithium disilicate (Li2Si205) crystals are formed, which impart the ceramic object with the desired high strength (**Ivoclar Vivadent, 2011**). Most thin veneers are made of lithium disilicate ceramic. This material, compared with other materials, for example, ceramics reinforced by lucite, has greater biaxial strength and fracture toughness. Because of these advantages، this ceramic material is frequently used in CAD/CAM production of single crowns or veneers (**Schmitter and Seydler, 2012**)

In the "blue" state, the material exhibits strength of 130-150 MPa and is thus comparable to other glass ceramic blocks available for the CEREC. Once milled، the blocks are crystallized in a furnace, which increases the strength of the material between 360-400 MPa. Not only is the strength increased, but the final color of the restorations is changed from the blue color to the final esthetic shade. During crystallization, which occurs at a temperature of approximately 840°, the material shrinks 0.2 percent, which has been already taken into account by the CEREC software **(Maclaren and Puri, 2013)**

1.7.4 Nano Ceramic/Resin

A recently developed nano-ceramic restorative material is a unique CAD/CAM block based on the integration of nanotechnology and ceramics. According to manufacturers, the material is said to offer the ease of handling of a composite material with a surface gloss and finish retention similar to a porcelain material. Lava UltimateTM (3M ESPE) contains a blend of nano-particles agglomerated to clusters and individual bonded nano-particles embedded in a highly cross-linked polymer matrix. It is a combination of aggregated zirconia/silica cluster (composed of 20 um silica and 4- um to 11-um zirconia particles), non-agglomerated/non-aggregated 20-um silica, and non-agglomerated/non-aggregated 4-um to 11-um zirconia with an approximately 80% ceramic load **(3M ESPE, 2012) (Fasbinder, 2012) (Fasbinder and Poticny, 2013)**. The fracture resistance of a material is a function of fracture toughness and flexural strength. With a reported flexural strength of 200 MPa, the nano-ceramic block has a higher initial strength than feldspathic and leucite-reinforced porcelain blocks, as well as veneering porcelains for porcelain-fused-to-metal crowns. The fracture toughness of the nano-ceramic material is greater than feldspathic materials and direct composites، while being less brittle than feldspathic glass-ceramics and, therefore, less prone to cracking during try-in and function. The inclusion of nano- particles in the Lava Ultimate block offers the potential for easy adjustment and creation of a high-gloss surface finish similar to porcelain. A reported advantage of the nano-ceramic material is its ability to retain a high-gloss surface finish over time, which is a limitation of composite blocks. In vitro studies by the manufacturer indicate that Lava Ultimate has a resistance to toothbrush abrasion and retention of the initial glossy surface finish similar to glass ceramics **(3M ESPE, 2012**) **(Fasbinder**, **2012؛)** (**Fasbinder and Poticny, 2013)**

1.7.5 Ceramic Resin Hybrid

The most recent material to be introduced from Vita is the Vita Enamic block. In this block, the dominant ceramic network is infiltrated with a reinforcing polymer network structure that is fully merged with one another. Due to the dual ceramic polymer network, the new material exhibits the benefits of ceramic and resin in one material. While the compressive strength of the blocks is similar to Vita Mark Il، the flexural strength is much higher, allowing the material to perform at high strength. Ideal for inlays, onlays and crowns **(Maclaren and Puri, 2013).**

1.8 Impression Taking

For making indirect restorations, PVS (polyvinyl siloxane) is the choice between the impression materials. The superior clinical performance of this material is due to:

- tear resistance
- low viscosity
- dimensional stability
- high capacity of elastic recovery
- the possibility of pouring twice. Obtaining a good antagonist stone model helps the accurate occlusal adjustment.

For this reason, a PVS should be used for molding both arches. Ideally, the two impression step must be used to obtain an accurate copy of tooth structure and gingival margin. However, the fundamental care should be retraction of the gingival margins for the impression. As a rule, when the retraction cord is inserted, retraction of the gingival margin takes place, which is suitable only for ceramics with cervico-vestibular termination. In the case of ceramic fragments, changing the cervical margin may produce over contoured restorations. A final artificial appearance is thus obtained and, possibly, change of natural emergence profile. Ultimately, there may still be tissue inflammation and gingival recession. To avoid this, the ideal is always to perform the impression of fragments without retraction cord, keeping the gingival margin in the natural position. However, the use of retraction cord in the proximal surfaces is essential in cases of diastema or when you want to create a new emergency profile throughout the cervical extension.

1.8.1 Impression Technique

- The technique demonstrated requires two viscosities of impression material, a light-bodied material to inject around the preparation and a heavy-bodied material to fill the tray.
- Two dispensing guns are needed. The dispensers are loaded with cartridges that contain the accelerator and base pastes (see A disposable automixing tip fits onto the end of each cartridge).
- The light bodied mixing tip has an accessory curved tip that is small enough to gain access to the smallest, most remote areas of the preparation.
- The first dispenser is used to mix and fill the impression tray with the heavy-bodied impression material. The dispensing tip should be kept embedded in the impression material as it is expressed into the tray so that the chance of trapping air is decreased.
- The second dispenser is then used to mix and inject the light-bodied impression material on the prepared teeth.
- Teeth should be examined to ensure that the field is still clean and dry. Any visible moisture on teeth is removed with compressed air.
- The retraction cord is gently removed with operative pliers. All preparation surfaces should be clean, dry, and exposed to view.
- Next, the opened gingival sulci and preparations are deliberately and progressively (moving from distal to mesial) filled over and beyond the margins with material from the syringe. To avoid trapping air, the tip is kept directly on the gingival and pulpal walls, filling the preparations from the gingival to the occlusal aspect, and the flow is regulated so that the material is not extruded too fast ahead of the tip.
- Light-bodied material also is injected on the occlusal surfaces of the unprepared adjacent teeth to eliminate the trapping of air on the occlusal grooves.

- After filling and covering teeth with material from the syringe, the cotton rolls are immediately removed and the loaded tray seated over the region.
- The manufacturer's product instructions should be followed with regard to how long the material should be allowed to set before removal. As an additional safeguard, the operator should test the set of the impression material wherever it is accessible at the periphery of the tray. When it recovers elastically from an indentation made by the tips of the operative pliers, it is ready for removal. See figures16&17 **(Roberson and Theodore, 2006) (Hill, 2007) (Layton, 2012) (Lieu and Nguyen, 2001)**

Figure 16: Light-bodied material also is injected on the tooth surface before impression with heavy body material.

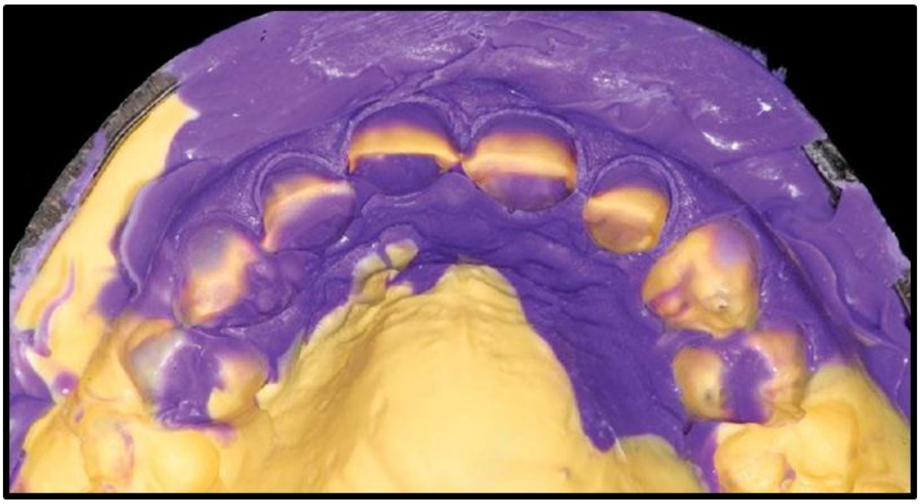

Figure 17: Poly vinyl silicone impression

1.9 Photography

In the case of anterior esthetics, a picture, and all that it is able to convey, is priceless. Using slides, prints or intraoral photographs enable the dentist to easily communicate invaluable information concerning the shape and texture of the teeth. The more sophisticated video imaging is also good at conveying information about the desired form. Pictures make it easy for the laboratory technician to actually see the tooth contours, the translucencies within the incisal edge, hypoplastic spots, enamel staining and the actual intensity of the characterization. Polaroid photographic prints of the try-in stage or composite mock-ups can be used along with the necessary information written on them to be sent directly to the lab. Instant film development is possible with digital photography, allowing the dentist and technician to review images via email, no matter the distance, and in only a few seconds. **(Dale and Aschheim, 1993)**

1.10 Veneers Temporization

Because intra-enamel preparations for etched porcelain veneers are by design very conservative, the resulting temporaries are inherently thin. Furthermore, they cannot be bonded in a similar manner to conventional temporaries for crowns, for example, because of the lack of inherent retention form. Moreover, since they are very thin, they cannot be made in the mouth and removed for trimming and subsequent cementing because of the high probability of fracture. Therefore, veneers temporaries must be made and placed simultaneously intraorally.

A clear polyvinyl siloxane material is used to make the preoperative impression from which the temporaries will be made.

If no diagnostic model is needed and the existing contours of the teeth are to be replicated, the impression for the temporaries is made directly in the mouth. However, as in this case, if a diagnostic wax-up was generated the clear polyvinyl siloxane impression is made from this diagnostic model.

Making the temporary from the diagnostic wax-up enables the clinician to see the contours of the wax-up manifested intraorally in the resulting temporaries, the impression itself is removed from the outer tray (no tray adhesive is used) and set aside for future use.

Following the preparation and impression of the teeth for porcelain veneers, the teeth to be temporized are "spot-etched" with 35% to 37% phosphoric acid. Only a 2-mm circle of enamel should be etched on the facial surface of each tooth to be veneered.

Because of the low viscosity of the bis-acryl temporary material, no bonding agent is required for bonding.

The bis-acryl material will infiltrate the etched areas for micromechanical bonding. These "spot-etched" areas will be the only areas to which the veneer temporaries will be bonded. If the entire tooth were etched, the veneer temporaries could not be readily removed.

After “spot etching,” only small etched circles evidenced by a frosted appearance should be present on the surface of each prepared tooth.The etched teeth must be kept clean and dry at this point.

The clear polyvinyl siloxane impression is quickly loaded with a self-curing bis-acryl temporary material and thereafter is immediately positioned in the mouth Once seated, finger pressure is applied to the peripheral areas of the flexible impression (since no outer hard tray is present) to express the excess material and “thin out” the resulting resin “flash.” When the bis-acryl temporary material has set, the clear impression is removed.

- The gross excess flash” material facially and lingually is removed with cotton pliers. Thereafter, a No. 12 blade held in a Bard-Parker surgical handle is used to carefully trim the excess temporary material around the margins of each tooth. The same No. 12 blade is used to carefully trim excess material in the gingival embrasure areas as well. A sharp large discoid applied parallel to the lingual margins is used to remove resin “flash” in the lingual concave areas.
- The temporary veneers are all joined together interproximally, increasing their collective strength and enhancing retention. A light-cured resin glazing agent is applied and cured to generate a smooth surface texture.Final.
- Appropriate adjustments can then be made intraorally in the temporaries to optimize occlusion and esthetics.
- A digital photograph of the final temporaries should be shared with the laboratory as a template for the final veneers.
- Patients must be instructed that they should not bite anything of any substance because of the weak nature of these veneers.
- These provisional veneers literally are more to accommodate esthetics and not function during the interim time until delivery of the final veneers. As

demonstrated in a different case, once the patient returns for the final try-in and cementation of the veneers, the temporaries are carefully removed by prying them from each tooth using a Black's spoon.

- The temporaries can readily be removed, since the only area where they actually are bonded to the tooth is the very small "spot-etched" 2-mm circle on the facial surface of each prepared tooth.
- Once the veneer temporaries are removed, the areas that had been "spot-etched" and bonded need to be lightly resurfaced with a flame-shaped diamond to ensure no residual resin bonding agent is present that could preclude proper seating and bonding of the final veneers **(Ritter and Andre, 2017)**

Figure 18: Temporization for etched porcelain veneers. **A** and **B**, Diagnostic models in anticipation of etched porcelain veneers. **C**, Clear polyvinyl siloxane (PVS) impression made from diagnostic model. **D–F**, Spot-etched areas for retention of temporary veneers.

Figure 19: Cont'd **H J L G** and **H**, Clear PVS impression is quickly loaded with bis-acryl temporary material, and positioned in the mouth. **I** and **J**, Impression is removed, and No. 12 blade in a Bard-Parker surgical handle is used to remove excess material. **K**, Glazing agent placed and cured. **L** and **M**, Final facial and lingual views of veneer temporaries**.**

1.11 Try-in

The provisionals should be taken out and veneers tried in without anaesthesia, making it easier to check the lip support and the incisal edge position relative to the upper lip. The veneers should initially be tried one by one in order to check the marginal fit accurately, and then together, to see their overall integration with each other, with the lips and finally, with the face **(Newsome, 2009)** well as، reason, the veneers should first be tried in using a translucent try-in paste. Try-in pastes are water-soluble pastes that are designed to simulate the color that is present in the final cements. The try-in pastes also act as a weak adhesive to allow the dentist and patient an opportunity to evaluate the PLV. Resin cement try-in done for color matching where if the color is acceptable cementation goes smoothly. Giti et al reported that the final color of leucite-reinforced veneering ceramic can be affected by the same shades of resin-based luting agents from different brands and different shades of resin-based luting agents from the same brand **(Giti et al., 2019)**. No corrections by adding material can be performed on porcelain veneers, and all occlusal checks should be performed after luting to avoid accidental fracture **(Banks, 1990)**, If resin composite veneers are used, it is possible to modify them before luting by roughening their surface, applying bonding resin, and adding a small amount of material **(Burtscher, 1993)**.

1.12 Cementation

Choosing the luting agent Exclusively light-cured resin cements are of choice for cementation of fragment-type restorations. **(Magne and Willian, 1999)** Relevant features deserving attention are:

- Greater color stability
- Higher working time
- Lower viscosity

With the great aesthetic demand and the evolution of materials for cementation it is possible to choose between light-curing cements based on a value scale rather than chroma, unlike other traditional light-curing cements, which, as a rule, are based on the VitaClassical® shade guide (Vita, Germany) as color reference. In addition to the option working with different degrees of lightness (value), The exclusively light cured cements have alternative photoinitiators in their composition and, therefore, are more translucent and less yellowish. However, they should be polymerized with different wavelengths. In general, these cements are composed of alternative initiators such as lucerin, Bis Acyl Phosphine Oxide (BAPO) and Phenyl Propanedione (PPD). The lower viscosity facilitates the insertion of ultrafine restorations and prevents their fracture during the bonding step. Is worth noting that the curing of these cements should be performed by third-generation polywave-type LEDs, because they have different lamps with range between 385 nm and 515 nm, which ensures the reaction of alternative initiators such as lucerin, BAPO and PPD.

1.12.1Tooth surface treatment (enamel and dentin)

The enamel surface must be etched with phosphoric acid <37¾). Th.is proced · · ure raise the surface energy of the structure, which result m excellent Wetting of the surface with the bond. At this point, care must be taken to evade contamination with saliva and breathe moisture, which can decrease tbe surface energy of the enamel. Hence, isolation with a rubber dam is highly recommended, which reduces stress input during the clinical procedure **(Pilathadka and VahaJova, 2007)**. While the etching of enamel with phosphoric acid leads to a "frosty' surface -a sign of a successful procedure, because of its inorganic content and excellent etchability -the effect of dentin-bonding agents on dentin is hard to control, because of its different composition of inorganic and organic components and tubular structure. It is not easy to gain the appropriate dryness or wetness of the surface, which is fundamental for a successful bond. Various types of dentin-bonding agents deal with surface wetness and the obtaining of a hybrid zone in different ways. Dentin-bonding systems are highly technique sensitive **(Frankenberger et al., 2008)**. In cases of dentin exposition, sealing this structure with a dental bonding agent is recommended directly after the completion of tooth preparation and before the final impression itself **(Magne and Douglas, 1999b; Donovan, 2008)** because the newly prepared dentin is ideal for the adhesion **(Magne et al., 2007; Frankenberger et al., 2008; Culp and Mclaren, 2010b)**. This technique, called the "resin-coating technique," consists of interposing a layer of low viscosity resin between the dental substrate and the luting cement (**Jayasooriya et al., 2003; Udo et al., 2007)**.This technique seems to maximize strength and minimize crack formation, bacteria infiltrations, and postoperative sensitivity, as it allows for acid conditioning of the enamel while avoiding the conditioning of the dentin and allowing better control of the conditioning of the enamel **(Bona and Anusavice, 2002).** A significant clinical benefit is that this procedure protects the pulpodentinal organ and prevents sensitivity and bacterial leakage during the provisional phase. The use of a conventional adhesive with three steps or autoconditioning with two steps, with polymerization of the adhesive separated from the composite resin, is recommended.

1.12.2 Clinical procedure of cementation

1. Prophylaxis with pumice and Robinson brush.
2. Packing of a #000 retraction cord mildly soaked in hemostatic.
3. . In the substrate, etching should be performed with 37% phosphoric acid for 30 seconds, in enamel, followed by rinsing with water jet and air drying.
4. The adhesive system is applied to the tooth surface which has been properly etched. After application of the adhesive system, excesses should be removed with the aid of a suction cannula and air jet is applied for evaporation of the solvent.
5. After seating the restoration on the tooth, the excess cement must be removed with the aid of brushes, dental floss and an indented metal strip. The initial curing for 3 seconds must be performed immediately after the previous phase. Note that removal with a brush before light curing aids in the formation of a line of continuous adhesion. As a result, there will be less bacterial colonization (Perakis N, Belser UC,2004) and there will be no gap formation from cement loosened with an explorer after initial polymerization. (Signore A, Kaitsas V,2013).
6. Removal of excess and application of glycerol to eliminate the inhibition layer and complete polymerization for 40 seconds on each side.
7. Removal of the cord and excesses with scalpel blade. See figure18

Figure 20: cementation of veneer

1.13 Maintenance

Success of any restoration depends on how the patient maintains it. Maintenance on the other hand should be a combined effort of dentist as well as the patient. Patient should be motivated:

Do's **(Gürel, 2003a)**

•Use a soft toothbrush with rounded bristles, and floss as you do with natural teeth.

•Use a less abrasive toothpaste and one that is not highly fluoridated.

•Use a soft acrylic mouth guard when involved in any form of contact sport.

•Ensure routine cleaning. Don'ts **(Gürel, 2003a)**

•Avoid food or drinks that may contain coloring.

•Do not use alcohol and some medicated mouthwashes because they have the potential to affect the resin bonding material during the early phase (the first 48 hours) .

•Avoid hard foods, chewing on ice, eating ribs and biting hard confectionaries and candy.

• Avoid extremes in temperature.

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