

Clinical Consideration, Lens and Ceramic Veneers, and its Applicable Ceramic Material

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Received: February 25, 2019; **Published:** March 29, 2019

Abstract

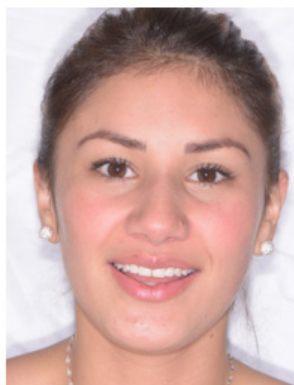
Aesthetic results of lenses and veneers in cosmetic treatments may vary depending on the clinical application; therefore, selection of this material should be selected by the dentist who is the one is aware of clinical requirements, instead leaving the choice to the lab technician. Ceramic laminates have been used for more than 20 years to treat esthetic and/or functional glitches, mainly in the anterior zone. A variety of dental ceramic materials are available on the market, nowadays exist in any different type of ceramics, depending on its composition, optic properties, strength and manufacturing processes. Clinicians need to know and understand the newest ceramic materials in order to be able to recommend apply techniques, and treatments to ensure success of clinical cases. Current literature was revised to pursuit for the most important parameters to determine the long-term success in cosmetic treatments involving lenses and ceramic veneers, giving to clinicians correct bases to choose the right application, being aware of its clinical limitations.

Keywords: Lens; Ceramic Veneers; Ceramic Material

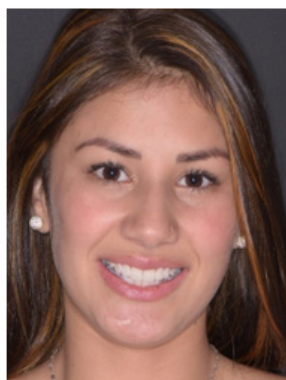
The wide variety of vestibular coating systems available today offers excellent alternatives with optimum results. In order to achieve excellence, we must respect the requirements of the patient, who may want a quality treatment but also fast, or it can be more detailed and expect results that have a high degree of aesthetics and naturalness, regardless of the number appointments. Another factor to consider is the working philosophy of each dentist. Some dentists strive artistic results with a high degree of complexity, while others prefer the safety, longevity, and the ability to make changes to the initial treatment and whose purpose is not strictly artistic.

All considerations are important in order to determine which material and technical fulfill the expectations of the patient and the dentist in the realization of a cosmetic treatment.

This article will review how you can achieve excellent aesthetics with materials and techniques ranging from highly complex relative simplicity.



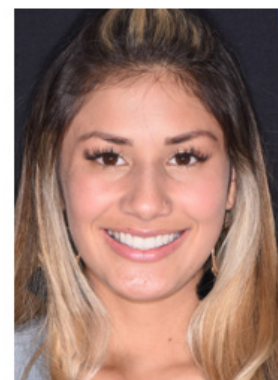
Initial Picture



Direct Mock Up



Preps



Final Smile

Figure 1

An esthetic smile is a wellness manifestation... as well as it is Health... and therefore... wellness is Health; furthermore using a correct ceramic material will improve periodontal health, aesthetics, longevity, and an everlasting beauty.

The key to success in oral rehabilitation today is not only eliminates pathologies, returning anatomy or function, but also restore dentofacial aesthetics of our patient.

How to differentiate between the terms “cosmetic” and “aesthetic” is to consider aesthetics as the theory and philosophy that explore the beauty while cosmetics refers to a preparation designed to beautify the body by direct application (<http://www.thefreedictionary.com>).

The word aesthetic is defined by Webster’s New Collegiate Dictionary as “a branch of science that studies the beauty found in nature and art”.

According to Hegel: “beauty, as the substance of imagination and perception, cannot be an exact science” [1] and smiles neither be created. The combination of biological concepts and mechanics are as important as the artistic and subjective when outlining the smile of a patient concepts in this chapter fundamental objective and subjective criteria will be developed to implement the protocol for performing dynamic and harmonious smiles with laminate ceramic, which can be veneers or lenses also called veneers.

Veneers laminated ceramic are delicate restorations that require a high degree of training thus part of the restorative dentist, as the ceramist, for adaptation, shape, strength, color and appropriate texture, and to satisfy the biological expectations and functional dentist and of course, the aesthetic expectations of the patient.

Dentists with an emphasis on cosmetic dentistry area should have an extensive knowledge of chemistry, physics, biology, architecture, engineering, psychology, art, morphology, color, among other fields and obviously health; today successful cosmetic procedures for short, medium and long term, and provide highly esthetic treatments, implies that must be and protocols.



Figure 2: *The challenge for the modern dentist is to imitate nature, natural teeth are not flat, nor smooth, nor monochromatic.*

Balance, proportion, symmetry, in a harmonious and aesthetic smile should take into account several parameters [2].

One of the most important is the relevance between the left and the right of both the face and the mouth and turn the similarity between the same type of tooth, such as the two central, lateral and canines, the more later are the similarity may be more irregular, and the more above the position of the teeth, the similarity should be higher. All of the above causes a smile cohesive forces, i.e. harmonious and for the same reasons a more aesthetic smile is created.



Figure 3

1. Nature has same properties we look for to imitate dental cosmetic treatments, translucency, opacity, brightness, texture, polychrome, harmony, balance, color, fluorescence, proportion.
2. Laminate veneers and lenses, reflect naturalness and move away from superficiality.

All these findings philosophers, thinkers and artists lead us to conclude that aesthetics is a subjective perception, which manifests itself in different ways depending on the individual, and is closely related to the ability of appreciation, culture, education, experiences, and association capability information of visual perception. All of these findings are easily influenced by fashion, race, culture, media, and trends. Generally speaking Beauty, involves talking about harmony and proportion, but not necessarily only these requirements are essential to create something beautiful.

From the Paleolithic cave paintings to modern digital photography, man has always tried to describe the world through images. Vision dominates our perception of the world: the human brain devotes more than 70% of its capacity in the sense of vision.

The vision is also closely connected with learning and memory. Concepts learned through the images are easier to remember concepts learned through word or deed. This phenomenon is known as superiority effect image. The art of visual thinking allows us to articulate complex thoughts and thus able to express more clearly and efficiently. and as a cosmetic dentists charge of offering patients more harmonious, aesthetic and healthy smiles, it is essential to apply the artistic criteria on scientific grounds based on evidence.



Figure 4: Proportion, harmony, symmetry, brightness, translucency in a smile frame.

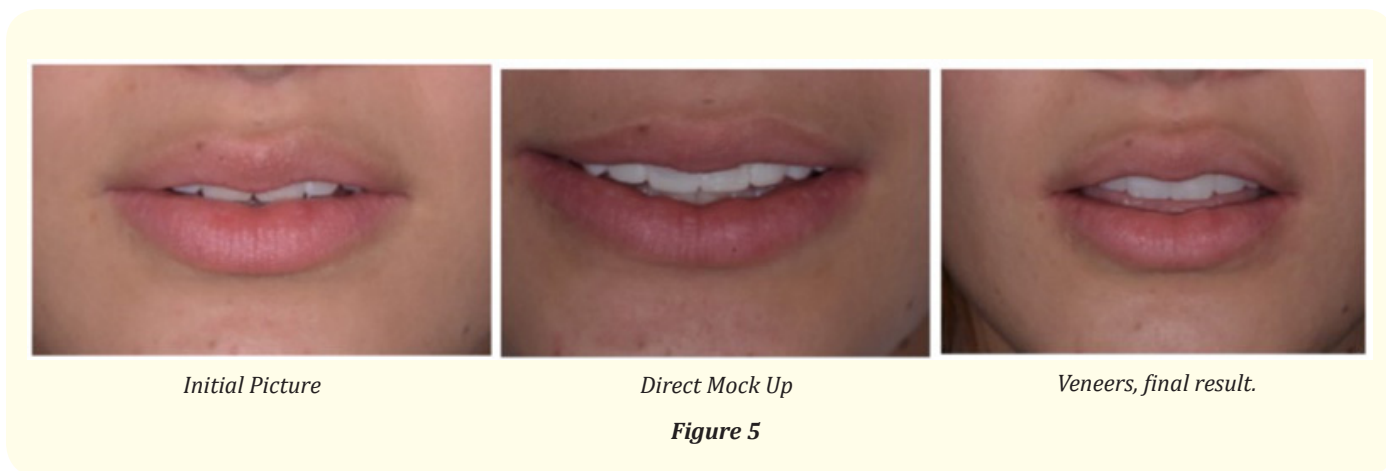
Dental aesthetics

The aesthetic prosthetic treatment is an integral procedure performed based on clinical examination and diagnosis, many elements have to do and are necessary to ensure long-term success of each of the restorations. Patient expectations, facial contour, eye position, shape, contour and lip movements are some of the factors that determine the incisal position, length and width of the veneers. The angle and position of each tooth is also determined taking into account these factors. Therefore it is important to know the essential parameters to create highly esthetic smiles.

The aesthetic prosthetic dental treatment involves restoring anterior teeth to the premolars, which are usually visible when speaking, this procedure is done to improve the aesthetics and function looking for functional stability and dentofacial harmony, and promote oral health and facial beauty, taking into account biological, aesthetic and mechanical principles.

A previous restoration or veneer natural, should mimic a natural tooth, and is considered ideal for a large proportion of dentists. However, the subjective point of view of the patient on the essence and objective view of the dentist not always coincide. Today, the aesthetic restoration must be balanced between the large desired by the patient and the preferred natural looking teeth by the dentist and white teeth.

The lips are the frame of a smile, to design a natural smile, nice and beautiful, you must take into considerations parameters that determine the position, length, shape and even the color. See Lips at rest.



One of the biggest challenges of modern cosmetic dentistry is to achieve shapes and textures simulating what created by nature, nowadays for many patients have a completely natural smile is not aesthetic, so the criteria of today have changed, the important thing is apply the current high standards of aesthetics, combined with the knowledge and application of new technologies and new materials, thus creating highly aesthetic and highly natural smiles [5].

Treatment with ceramic veneers are very aesthetic and durable, they are ideal for creating attractive smiles with lasting success, performed in short, medium and long term; minimally invasive techniques are used, technology and materials with high physical and mechanical properties, are used to ensure patient aesthetic and mechanical satisfaction, and biological and functional requirement of the dentist.

The author Naoki Hayashi, RDT [6], it has established a classification based on restorative treatment complexity. Desires and expectations of a patient can be organized using this classification and to plan a treatment. Each case has a particular treatment objective. Each type of restoration is special to harmonize both patient's dentition and facial aesthetics and likewise the overall aesthetics of the patient.

- Type 0: Basic restorative treatment. Treatment is limited to vital problems (i.e. pain, dislodged or damaged pre-restoration).
- Type 1: Natural restorative treatment. Treatment is limited to a decayed tooth discoloration. The main goal of treatment is to harmonize the color, shape and function of the treaty with the adjacent tooth dentition.
- Type 2: Natural restorative treatment improved. Multiple teeth are involved in the treatment to fix all the teeth to look and function naturally.
- Type 3: Aesthetic treatment. The prosthetic treatment is performed to improve the aesthetics of the above teeth mainly to harmonize with the dynamics of the face and lips. Treatment is indicated for aesthetic purposes, not solving a functional problem.

- Type 4: Aesthetic + total oral rehabilitation treatment. Comprehensive treatment includes orthodontic and surgical treatment in addition to the prosthetic treatment. Dentition, including the shape and color of teeth idealizes according to the wishes and expectations of the patient. The appearance of the face, lips dynamics and dentition, need to be harmonized to improve aesthetics and function.

Choice of ceramic material according to clinical indication

According to this indication we can classify patients into two groups:

1. **Need to Change Color:** When the intrinsic tooth color is very dark, the end result of cementless veneer may be affected. The final color depends on the translucency and thickness of the veneer, and the amount of light that is absorbed, reflected and transmitted, which depends on the nature and particle size of the ceramic material.
2. **Functional forces:** When occlusal functional forces are excessive is necessary to use a material with high resistance to fracture. I.e. in cases of overbite, bruxism, fractures or large diastema.



Figure 6: Ceramic lens: cervical thickness 0.2 mm/incisal thickness 0.5 mm.



Figure 7: Ceramic Veneer: cervical thickness 0.5 mm/incisal thickness 1.1 mm.

Biology

Basis of enamel and dentine

Tooth structure has several important properties, which are desirable to replicate in biomimetics and bio-ceramic. Paramount is the mechanical efficiency; largely it is a function of the crown, enamel thickness, its microstructure, and the root structure [12]. Related to this proprioception, internal perceptions that discourage individuals to transmit excessive loads through enamel, dentin and supporting structures and therefore reduce the likelihood of catastrophic failure con fracture [13].

Materials

Clinical success in implementing aesthetic treatments with modern dental ceramics is based on a number of factors, such as physical properties, and its method of manufacture, besides clinical considerations. This article will summarize the logic behind engineering materials, biomimetic ceramic, and clinical dental restoration, then critically I describe the basic methodology and protocols reported in the recent literature.

It is responsibility of the dental technician to use their knowledge to guide the choice of ceramic material to be used, based on the expressed needs of the patient and transmit it to him by dentists, but in turn, dentists must have the necessary knowledge about dental materials, and its clinical applicability.

Properties of ceramic materials

Before entering in subject of Ceramic Veneers, it is important to get to know some basic characteristics of ceramic materials, today there is great diversity of types of ceramics and each has different indications. To achieve the success of a cosmetic treatment with ceramic veneers, it is essential to learn at least the microstructure of ceramic materials and their method of manufacture, and to better know their usage characteristics and properties and to apply this knowledge in practice dental.

The new generation of ceramic materials has several interesting options, both in selection materials and manufacturing techniques [14].

Depending on the clinical case, the choice of material must be very rigorous; meanwhile long-term success depends on it. Clinical materials with more resistance require more power to generate a crack, and are more resistant to stress corrosion (crack generated chemically) and residual defects (inside the material), but exist the fact that while material is more resistant, it is less aesthetic, subsequently more fragile [15,16].



Figure 8: Diagram of ceramic crack.

Properties

Hardness

Opposition exerted by the materials to be altered, deform, penetrated, abrasion, scratched, or chopped permanently.

Fracture Toughness

All ceramic fracture need a crack propagation of a minimum of 0.1 MPa [17]. Most dental ceramics exhibit superior resistance greater than enamel fracture resistance.

Fluorescence

Fluorescence is the property of materials or substances to reflect light with longer wavelength than that the one received. A fluorescent object radiates a larger amount of light that receives, making brighter than a non-fluorescent object.

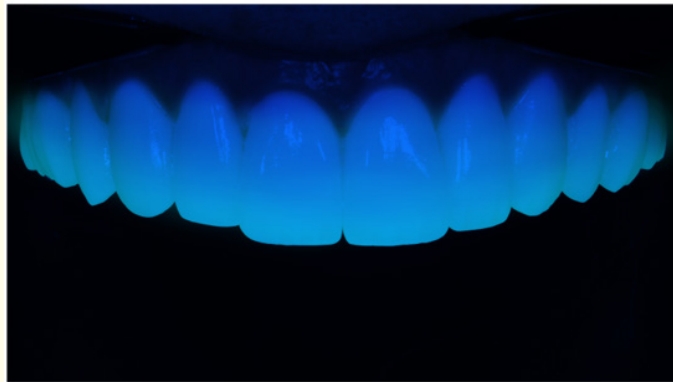


Figure 9

Translucency

Property of a body to let pass a light through itself. The opposite it is called opacity.

Ceramic materials

The industry strives to maintain a development plan structured and systematic to ensure the quality of products within specific guidelines greater aesthetics and durability. Today there are many new ceramics in the market, generating more alternatives and more controversy to dictate clinical use. I'll do a recount of some ceramic materials available today, to facilitate the choice of material to use in each case and create successful treatments Veneers.

Ceramics are inorganic, nonmetallic solids produced by heating high temperatures of compounds as nitrides, carbides, borides and metal oxides [18] and its subsequent cooling.

The way ceramics are processed have great influences In its mechanical behavior and, in consequence, in their clinical behavior.

This article will classify ceramics into two groups for better understanding and clinical applicability. According microstructure [19] and as its method of manufacture [20].

Only by knowing the characteristics, virtues and drawbacks generated in each type of ceramic according to their mode of production and composition, the dentist will have safety and provide quality in the planning and execution of their treatments, All ceramics are different, some are more fragile, or more resistant to fracture, more translucent or more opaque. Knowing only this material may be thoroughly

Ceramics classification according to their microstructure [18,19]:

1. Predominantly glass: Have high glass content making this type of ceramic very esthetic; it has excellent optical and aesthetic effects.
2. Glass reinforced particles: Glass matrix filled with particles to improve mechanical properties.
3. Polycrystalline: The atoms are packed in a regular crystal thereby making it more resilient and less susceptible to crack propagation. This is ceramic is so much resistant to fracture than others above.

Important: high aesthetic ceramic are predominantly glass, therefore more fragile.

To improve aesthetics of anterior teeth, many time is the same language of lenses, veneers or laminates, nowadays, commonly two types of materials are recommended; for its translucency and its potential to use thin thicknesses. According to their mode of manufacture the sintered feldspathic and filled with particles ceramic can also used with manufacturing CAD/CAM (computer) techniques. According microstructure ceramics can vary from being very translucent to opaque thus the glassier microstructure (non-crystalline), more translucent ceramics will be, if more polycrystalline more opaque the ceramic will be. To offer an aesthetic translucent ceramic veneers it must be made with materials that expose optical.

Then, I will make a short to better understand ceramics, according to their microstructure, as McLaren summary [21].

Glass ceramics: powder-liquid

Traditionally feldspathic porcelain is usually used for covering veneers and metal structures. These liquid porcelains are created from materials containing mainly silicon dioxide and have a glassy matrix and varying amounts of a crystalline phase within a glassy matrix. These ceramics are made by hand, typically use powder and liquid. They are generally the most conservative and the most translucent of all ceramic materials, but are also the most fragile. The high translucency and aesthetics of these materials create an illusion of natural teeth. Porcelain materials made of powder/liquid are ideal for cases where remaining enamel is significant and there is healthy tooth structure, 50% or more and 70% or more of the margin is in the enamel.

The technique for creating this type of wet ceramic is done with a special brush, layer by layer, compacting it by removing moisture excess with absorbent paper, and then it is overheated on ceramic vacuum, increasing its compaction. The feldspar ceramic compressive strength is 60 to 70 MPa. Veneers made with feldspathic ceramics must be cemented on teeth with very good thickness of remaining enamel, teeth that do not need correction of severe versions or teeth with extensive fractures, or teeth that need excessive length increments and dark colored teeth because of its high fragility and low resistance.

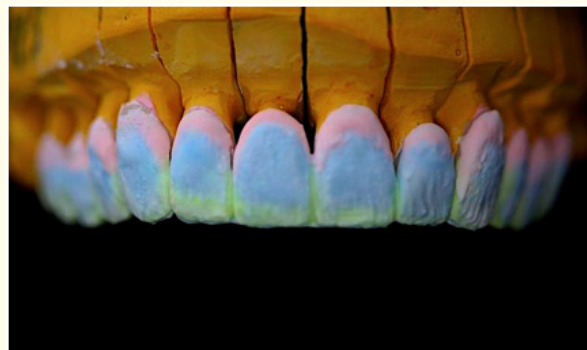


Figure 10: Feldspathic Ceramic.

Glass-ceramic filler particles

It is the same feldspathic ceramic with glass matrix, but some particles are added to increase their strength. Clinical use depends on the type of filler particles and manufacturer. These materials generally using CAD/CAM technology or pressed, commercial form is in blocks and are available monochromatic or multicolored. This ceramic is indicated for almost all types of restorations, including inlays, crowns, short bridges, veneers and ceramic abutments.

The composition of this type of ceramic is similar to feldspathic porcelain because both have a glassy matrix, but the two classes differ in their glass-crystalline and crystalline types relationships. Based on its type of glass and its mechanical behavior; the reinforced glass ceramics particles are subdivided into two types:

1. Glass ceramics reinforced with leucite, less than 50%,
2. Glass ceramics reinforced with lithium disilicate, more than 50%.

Glass ceramics reinforced with leucite. They have demonstrated clinical success in long term on medium stress situations. They can be very translucent, but traditionally this ceramic required slightly thicker dimensions, i.e. thickness 0.8 mm for laminated with a porcelain coating. The materials on this subcategory have demonstrate increment in the material strength, mainly due to the processing using a thick block, due to leucite and its ability to alter the thermal expansion coefficient, inhibiting the spread cracks. Its hardness is 120 MPa. So, the ceramic veneers made with this material should be very good when cemented with enough a tooth remainder, not large diastema or big cracks.

Glass ceramics reinforced with lithium disilicate, more than 50% when fabricated monolithic be used for full crowns, including the molars. Veneers made of this material can have a thickness up to 0.2 mm and still remain resistant and highly esthetic. Its hardness in MPa is 360 - 500. for its high fracture resistance, hardness, chameleon effect, ceramic veneers reinforced with lithium disilicate, can be cemented in the most aesthetic and functional situations, allowing hide the intrinsic color of the tooth, providing translucency, high aesthetic and giving the fracture toughness and hardness requiring anterior restorations in teeth requiring large changes in shape, size and color. 0.2 mm still will remain resistant and highly esthetic.



Figure 11: Waxed laminates lenses, ready for coating process, followed by wax evaporation process to continue with press injection of reinforced ceramic with lithium disilicate.



Figure 12: Injected lenses even with the sprue in position.

The new addition to this category are ceramics reinforced with lithium disilicate more than 50% of its composition is reinforcing with zirconia particles (ZLS). ZLS materials include glass-ceramic lithium silicate which is reinforced with about 10% of zircon crystals. These materials are new in the market, in initial vitro tests have shown that possess excellent optical and physical, similar to lithium disilicate properties. However, only lithium disilicate have long-term clinical data to support its use as unique restorations anywhere in the mouth, keeping its optical properties. Since this type of ceramic includes zirconia particles, translucency decreases, making it more opaque, and therefore less aesthetic. Restorations made from materials in this subcategory, show high resistance to fracture, providing a versatile and strong alternative to a smaller variety of indications. They are indicated when there is higher risk (for example, less than 40% of enamel remains in the tooth, less than 50% of the substrate, or when 30% or more of the margin is in dentin or there complement is metal crown.

Classification According to Griggs [20] for manufacturing ceramic veneers according to their method of manufacture: (More Popular Techniques).

Heat pressing

The heat pressing using lost-wax technique, similar to that used to melt gold crowns in a mold investment developed from a wax pattern evaporates in an oven, the ceramic selected tone is pressed in the mold at high temperature (about 1160°C) and pressure (0.4 MPa), with a denser core.

Press or Injected ceramics are available as ceramic ingots supplied by manufacturers. However, ingots have a similar composition to powder porcelains; but less porosity and crystalline content [24,25]. The ingots are heated to an elevated temperature, where it becomes a highly viscous liquid, and then slowly pressed into the preforming mold.

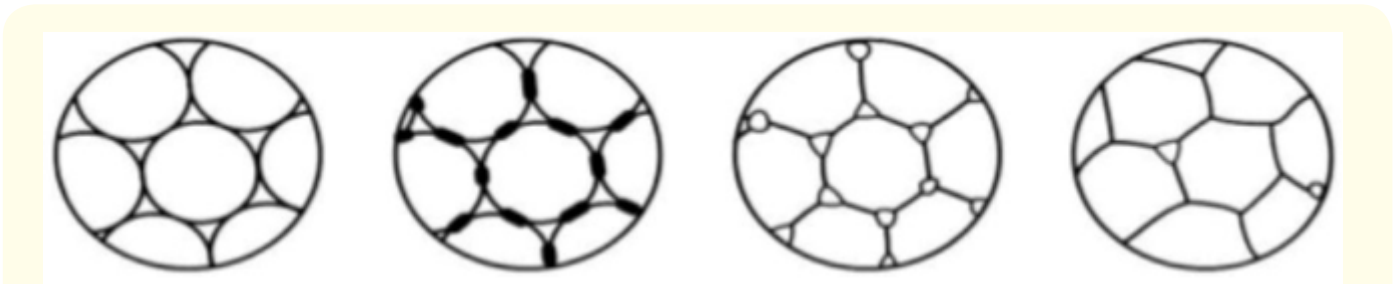
CAD CAM

Several pre-processed ceramic materials are available in blocks for use with CAD/CAM technology. An optical impression of the prepared tooth either in the dental office or transmitted to the dental laboratory is made [26,27]. A computer program is used to design the restoration to set the contours, proximal contacts, occlusal contacts and margins. A block of ceramic material is selected with appropriate color and placed in a milling machine. A computer, using the design created, instructs the milling device to mill the restoration. Depending on the selected material, a thermal or sintering processing may be necessary to complete the firing of the ceramic material. Custom staining and glazing of the restoration can be made to achieve maximum aesthetics.

Porosities of ceramic are weakest points in the material leading to the development of small cracks propagating and eventually cause a fracture on the restoration. In general, monolithic restorations are stronger than covered ceramic restorations. Coated restorations have the potential to be fragmented or separated into the binding material and into core material (called delamination) [28].

Sintering

Before entering this issue it is important to know that some modern ceramics require additional process to improve its features. Sintering occurs when the ceramic particles are heated to the point that they melt and fuse to adjacent particles at their edges. Firing the ceramic vacuum is necessary to reduce the porosity to produce a stronger material [29]. When a material is sintered it increases its flexural strength. Nowadays ceramic sintered is less common and ceramics heat machined or pressed are more used [30].



1. Initial ceramic particles. 2. Diffusion: Neck formation in contacts points. 3. Reduction of pore size. 4. Pore Size is totally reduced, standardized shrinking-fully sintered part.

Figure 13

An ideal material that meets all aesthetic and mechanical requirements of all ceramic veneers treatments is lithium disilicate reinforced ceramic. Ceramic blocks of this material have high stability values (360 - 500 MPa), which makes them suitable for manufacturing highly compact and high fracture resistance veneers, which also have different degrees of opacity and translucency allowing very thin structures, resistant with excellent color stability aesthetic restorations.

Advantages and disadvantages of ceramic laminates

Advantage

- Color, It is a double advantage; new ceramics offer natural shades while providing long-term stability and permanently concealing dentin or enamel intrinsic alterations.
- Fracture Strength, ceramic reinforce; adding filler particles that makes veneers more stronger and more resistant to fracture.
- Periodontal stability, veneers by its self-glaze opposes plaque deposition more than any other system, sometimes the accumulation of plaque is even less than the human enamel.
- Abrasion resistance, Its wear resistance is exceptionally high compared with composite resin material, being similar to tooth enamel.
- Hardness, a single un-cemented veneer or lens is highly fragile but once adhesion to enamel is in place, cohesive, tensile forces increase considerably, bond strength is much stronger.
- Longevity depends on its hardening, clinical studies report success up to 10 years and with good maintenance, even 20 years.
- Esthetic, The aesthetic factor is considerably better than any other material, it is easy to control color; thickness, shape, fluorescence, opacity, gloss, texture, translucency, producing aesthetic treatments with dynamism and vitality perception.

Disadvantages

- Time, an unflawed veneer treatment is a sensitive technique and therefore requires more time and dedication.
- Repair, once cemented veneers or lenses are not easy to repair.
- Sensitive technique, it is an indirect technique that requires at least two visits and high expertise both dentist and laboratory technician.
- Fragility, these restorations are very thin so they are very fragile and easily fractured prior to cementation.
- Costs, because of its manufacturing process, costs increases.

Conclusion

The use of porcelain laminates (lenses and veneers) to improve smiles with aesthetic or functional problems have shown to be an enhancement management option, but it is critical that clinicians know all ceramic options that are available in the market today, knowing different ceramic systems, characteristics and properties dentists would be able to offer a suitable, esthetic and long lasting cosmetic treatment result for each individual case.

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Volume 18 Issue 4 April 2019

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