

Literature Review Article

Conservative esthetic solution with ceramic laminates: literature review

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Received for publication: June 5, 2013. Accepted for publication: November 26, 2013.

Keywords: dental veneers; ceramics; dental esthetics.

Abstract

Introduction and Objective: Modern dentistry seeks to offer increasingly esthetic treatments, aimed at patient's well-being and satisfaction. In this perspective, this study aimed to conduct a literature review on the use of ceramic laminates as conservative and esthetic solution, addressing their indications, contraindications, limitations and its importance in dentistry. **Literature review:** The evidence in the literature show that the ceramic laminates are used for restoring anterior teeth, reestablishing dental function and esthetic mainly due to its excellent optical property, and preserving tooth structure, as it is necessary less tooth wear to return shape, texture, color and harmony to the teeth involved. **Conclusion:** It was conclude that this is a treatment option with high success rate when properly indicated, planned and executed according to each case.

Introduction

Esthetic Dentistry is increasingly gaining attention because of the great appealing of the media and beauty

pattern imposed by the society itself. Consequently, the patients' demands are also increasing in relation to the quality of restorations, mainly those involving the anterior restorations [19].

Esthetics is the science of either mimicking or harmonizing a restorative treatment with nature, but it should not be restricted to restore shape and function of the teeth; accordingly, it should act on the capacity of reestablish a new smile adapting to the patient's life style, job, social position as well as highlighting the esthetical features [6].

The development of restorative materials and techniques has been stimulated because of the higher esthetical demanding and searching for a more natural appearance of restorations at dental offices [5]. Current Dentistry seeks "invisible restorations", which mimics natural teeth executed with the minimum damage to tooth tissues. This union among the improved restorative techniques, materials with biomimetic properties and the philosophy of preserving the remaining tooth structure favors the obtainment of healthy, functional and esthetical smiles [16].

Dental ceramics are a good restorative option attending precepts of smile's function and esthetics [18]. Among the existing restorative esthetical materials, ceramics has been detached because is the material most similar to the natural appearance of teeth [2]. Ceramics is the material that best reproduces the optical properties of the enamel and dentine, such as fluorescence, opalescence, and translucency, as well as desirable intrinsic features as biocompatibility, high compressive strength and abrasion resistance, and color stability [10].

Ceramic laminates has gained largely acceptance as the main protocol of restoration in esthetics Dentistry. Because patients' esthetical demands continuously increase, dental staff has been challenged to identify a systematic approach to reach natural oral and facial esthetics with ceramic laminates. The advances in ceramic materials and coating techniques enable the professionals to restore function and esthetics by using conservative and biologically compatible methods to promote oral health at long term [11].

Smile alterations may be caused by different factors, as caries, tooth darkening, aging, bruxism, chemical erosion, and malocclusion providing an imbalance in dentofacial esthetics. Among the procedures indicated to restore the functional esthetical outcome, ceramic laminates are highlighted [4]. Thus, a proper treatment planning comprising study models mounted in semi-adjustable articulator and a good communication with the dental technician will provide greater treatment predictability [18].

The aim of this study was to review the literature on the use of ceramic laminates as conservative

esthetical solution, reporting its indications, contraindications, advantages, and disadvantages, as well as its role in Dentistry as functional and esthetical material.

Literature Review

Definition

Ceramic laminates are a possible conservative esthetical restoration that maintains the tooth structure (because the minimum wear) during the preparations and enable performing a favorable esthetical change with excellent durability [7].

These are an excellent restorative option when well indicated because they require the minimum wear of tooth structure and restore tooth morphology, shape, texture, color and harmony. When bonded to tooth enamel, they show excellent clinical longevity [16].

This type of restoration comprises the coating of the labial surface of tooth enamel by a restorative material, strongly adhered to tooth thorough the most recent advances of the adhesive systems. The restoration can be executed by either direct technique through using resin composite or indirect technique through ceramics [4].

Indications

Ceramic laminates have been indicated in the following situations: teeth with marked color, amelogenesis imperfecta, which require the changing in the crown shape; teeth with large cervical lesions or caries involving the labial surface damaging esthetical appearance; teeth with alteration in positioning on arch, teeth with minimum giroversion or little lingual/labial inclination can be realigned in only two clinical appointments through ceramic laminates. Moreover, short or worn teeth are also indicated because tooth crown lengthening with ceramic laminate achieves a harmonic esthetical outcome in relation to color, shape, and position, but it is essential that the patient shows adequate posterior support [7].

They can be indicated in cases of fractures in young tooth, teeth exhibiting large erosion on labial surface, anterior teeth with cervical restoration, teeth requiring diastema closure, and individual tooth with marked lingual inclination; also, patients desiring whiter and more esthetical teeth [16]. They have been indicated in the case of alteration and

correction of occlusal relationships, such as guide change and vertical dimension [9].

Contraindications

Teeth with reduced crown structure contraindicates the use of ceramic laminates because when less than the half of the coronal structure is present because of removing large caries lesion or presence multiple restorations, normally there will be a very large limitation to indicate ceramic laminates. Patients showing parafunctional habits, such as harmful mechanical habits (pencil, nail biting) are not ideal candidate for ceramic laminates [7].

Ceramic laminates have been contraindicated in patients presenting severe bruxism; anterior teeth with large composite restoration or excessive destruction; high carious activity; and poor oral hygiene [25].

Advantages

The main advantage of ceramic laminates is esthetics, in addition to less accumulation of plaque when compared with resin composite and longer clinical longevity. Current longitudinal studies, ceramic laminates had a success rate above 90% after 10 years when ceramic restorations were bonded through adhesive technique. Tooth preparation should preserve the enamel as much as possible, because when ceramic laminate is cemented onto teeth prepared on dentine, the success rates may fall close to 60% [1].

Ceramic laminates show as advantage, the longest clinical longevity in comparison with direct resin composite veneers in addition to provide reinforcement to tooth structure [7].

The preparation of veneers with minimum wear, most times, is limited to the labial surface and incisal edge of clinical crown. Generally, laminates have a supragingival terminus or slightly subgingival, sealed with resin cements, so that the gingival health is little or not compromised [25].

Disadvantages

Ceramic laminates show as disadvantages the possibility of dentinal sensitivity and difficult of repairing if fracture occurs. The construction of ceramic laminates exhibited a complex execution both at the clinical and laboratorial steps [2].

It is always a big challenge to aggregate color, shape, surface texture and individual features within a restrained space, leading to high costs. The irreversibility is also a disadvantage, because once installed, future correction is only very limited. A ceramic laminate can only be removed through wearing and replaced by a crown [25].

Very invasive preparations increase the failure chances because the more invasive the preparation, the greater is the risk of fracture or displacement [4].

Over time, color changes may occur due to either ceramic or cement discoloration which causes a slight darkening of the ceramic laminate, jeopardizing the esthetics which is very unpleasant for the patient [25].

Limitations

Additionally to higher cost when compared with direct composite resin technique, the construction of ceramic laminates demands the expertise, ability and knowledge from the dental technician. It also demands care in their handling during the proof and cementation steps, because they are very fragile before the bonding with resin cement [7].

Teeth exhibiting marked crowding, giroversion or labial inclination are very challenge because they normally require the need of executing a large wear during the preparation, which generally makes difficult or even derails the indication of ceramic laminates [7, 25].

Still, other factors can also limit the use of ceramic laminates, such as periodontal inflammations, low insertion of the labial frenulum, large restorations and marked diastemas [9].

Importance in Dentistry

Currently, because of the improvements of adhesive systems, resin cements, and ceramics, it is possible to execute restorative treatments with high esthetical standards and maximum preservation of tooth structure. Among the minimally invasive options, the construction of ceramic laminates have gained attention due to their satisfactory clinical outcomes and proved longevity [6].

Usually, restorative Dentistry executes tooth preparations based on the necessity of minimum thickness for materials, without taking into consideration that, most of times in esthetics, the shape and final position of the tooth will be changed, which causes considerable discrepancies

in the wear of tooth structure, and consequently in excessive removal of healthy tooth tissue [12].

Ceramic laminates have proved to be a well successful treatment modality for esthetical rehabilitation in clinical practice and in controlled clinical trials. Longitudinal studies have shown excellent outcomes, including low prevalence of displacement, microleakage, fracture and caries [20].

Preparation types of ceramic laminates

By studying the effect of different preparation designs of alumina-reinforced ceramic laminates on tension distribution, researches have compared preparations on the maxillary central incisor comprising only the labial surface with those involving the incisal edge. The study demonstrated that the involvement of the incisal edge exhibited the best outcomes, but the ceramics concentrates most part of the tensions because of its mechanical properties of high rigidity (modulus of elasticity) and low compressibility rate (Poisson coefficient) [28].

The preparation deepness is determined by the color alteration, extension of old composite restorations and tooth position on the arch. At the ending of the preparation, this should be refined with fine-grit diamond points, aiming to remove irregularities and round the angles, making ease the laminate construction and reducing the tension concentration [7]. The preparation of ceramic laminates should be executed conservatively, preserving the incisal edge of the tooth to obtain a wear thickness of 0.5 mm, with chamfer terminus, either supra- or subgingival [23].

The preparation uniformity can be easily achieved by using round diamond points on the cervical area compatible with the wear thickness to be achieved on the labial surface. Approximal wear should be performed with the aid of metal sandpapers to create spaces between the teeth, making easy the impression and posterior cementation. It is important to use a silicon matrix to guide the amount of tooth reduction. Finally, all angles should be rounded through fine-grit diamond points, silicon rubber points, abrasive discs and flet polishing discs, to achieve a final wear of 0.8 mm at medium third height and 0.4 mm at cervical third [24].

Types of ceramics indicated for constructing laminates

To construct laminates, there are two options of available ceramics: feldspathic and lithium disilicate [23]. Feldspathic ceramics of low fusion applied on refractory die are the most used for laminates because they provide better adaptation and safeness and are capable of undergoing acid etching [15].

Highly esthetical dental ceramics have a high content of glass and better mimic the optical properties of the enamel and dentine because of the translucency and opacity degree of these totally ceramic systems. Thus, it is important that the professional has a good knowledge on these systems to maximize the esthetical outcome and select materials properly to assure treatment longevity [13].

With regard to the color alteration of pure ceramic restorations and the challenge of choosing the ideal color in minimum preparations on enamel, researches have analyzed the optical properties of different ceramic systems. They believed that the temperature difference and pressing or milling could interfere on ceramic texture and consequently optical property. Thus, 60 specimens with 10 mm of diameter and 5 mm of thickness were constructed with shade A1 of: IPS e-max Press, IPS e-max CAD, IPS Empress Esthetic, IPS e-max Ceram, IPS Inline and IPS Zir Press. The color was evaluated through visual and electronic color scale three times by three calibrated evaluators. Next, the specimens were submitted to aging machine. None of the ceramic systems was capable of altering the color obtained by the color scale; the chemical structure of the ceramics have more effect on determining the optical effect than the construction technique and aging result in a darker, more opaque and yellowish ceramic [3].

Cementation of ceramic laminates

Resin cement is the most indicated for cementing laminates with light and chemically-cured (dual) or only light-cured because of the thickness and transparency of laminates [23].

The laminates should be positioned simultaneously on teeth, without the use of matrix, with caution regarding to the cement viscosity so that it does not occur maladaptation of laminates, and light-curing for five seconds to make easy the cleaning of the resin excess around the margins [27].

A study concluded that the increase of the ceramic coating from 0.5 to 0.7 mm does not significantly affect the final color of ceramic laminates constructed through CAD-CAM system after cementation; however, the final color is significantly affected whether this thickness is reduced to 0.3 mm and the type of resin cement is a factor influencing on the color alteration of laminates in addition to their thickness [22].

The longevity of ceramic laminates is associated with the outcome predictability by planning and execution techniques, favoring the patient/professional relationship and surpassing positively the mutual expectations. Thus, it is important to use the proof paste previously to the cementation of ceramic laminates, an important tool to decrease errors, define esthetical outcome predictability and consequently the patients' satisfaction, because the use of Try-In paste is an essential step in the rehabilitation process with ceramic laminates [4].

A study conducted aiming to evaluate the color influence of the resin cement on the final shade of minimally invasive ceramic laminates after the artificial accelerated aging (AAA), was performed with 20 bovine teeth. These were collected, prepared, and divided into two groups. For group I (n = 10) the resin cement White-Opaque (WO) base paste was used, and for group II (n = 10) Yellow (Y) base paste. Each specimen was light-cured for 60 seconds. The specimens were then submitted to AAA. Color readings were executed with the aid of a spectrophotometer at three moments: after preparation (only the substrate), after cementation and polymerization and after AAA. Values of L*, a* and b* were obtained and total color change was calculated (ΔE^*). **The authors concluded that both cements were capable of masking the substrate color. After AAA, only Y showed a clinically unacceptable ΔE^* value, becoming more yellow (greater b*) and losing luminosity (smaller L*) [17].**

The cementation technique itself consists of separately treating the internal surface of the laminate with 10% hydrofluoric acid aiming to create retentions and improve bonding strength between the ceramic and resin cement; following, to wash the laminate for 60 seconds, dry and activate the surface with silane agent for 60 seconds. However, it could be differences in the preparation of the laminate regarding to the exposure time to hydrofluoric acid, which ranges according to the restoration material, from 2 minutes for feldspathic ceramics, 60 seconds for leucite-reinforced ceramics and 20 seconds for lithium disilicate ceramics [8, 14].

Discussion

The esthetics, for the human being, is a highly subjective concept, because it is related to social, cultural and psychological factors that are altered in function of time, life values and individual's age. Accordingly, the evaluation of the patients' expectations and the understanding of the therapeutic solutions are essential previous to begin any treatment planning [5, 6, 21].

In this context, an observational cross-sectional study conducted through questionnaire with undergraduates aimed to verify the esthetical self-perception of the smile. The results showed that women were more dissatisfied with their own smile than men and the first semester undergraduates would like to have whiter teeth [21].

The ceramic restorative materials have demonstrated many advantages, with main advantage a natural esthetics without presenting significant alterations regarding to its color or superficial texture. Undoubtedly, it is material that best mimics natural teeth in color and translucency in addition to show biocompatibility, good compressive strength, color stability, radiopacity, and simulate tooth appearance [10, 18, 19, 21].

Ceramic have also exhibited some disadvantages, such as low mechanical resistance and the presence of microporosities on the surface. These latter may predispose the material to crack propagations that may lead to restoration failure. Moreover, they have presented high costs and difficulty of repair in cases of fractures [2, 25].

Current restorative Dentistry states that, for any procedure type, the dental professional should always opt by the most conservative treatment. Thus, the esthetical rehabilitation through ceramic laminates is the most indicated treatment because its preparation preserves the tooth remnant the most [2, 4, 6, 19].

Ceramic laminates are contraindicated for patients exhibiting parafunctional habits as bruxism and those with poor oral hygiene; however, a strict and multidisciplinary planning enables the adequacy of probable contraindications of ceramic laminates [5, 6, 25].

The preparation for ceramic laminates should preserve the maximum of tooth enamel, because when the preparation is executed on dentine, the success rates may decrease. The preparations on enamel have exhibited greater advantage, because the adhesive systems show smaller degradation and greater bonding strength to tooth enamel. Enamel terminus assures a smaller microleakage rate and greater restoration longevity [1]. On the other hand,

a dentine terminus demand the dentinal sealing technique immediately after the preparation ending to improve the bonding of the laminates and decrease microleakage that is significant when the cervical margin of the preparation is on dentin [6]. Because of the thin thickness of ceramic laminates, the color of tooth substrate may compromise the final esthetic outcome. Therefore, to neutralize the influence of this substrate, the professional should previously perform tooth bleaching and/or employ a variety of color of resin cements [4].

When the ceramic/resin cement ratio is greater, a larger ceramic area exists to distribution the tensions to the adhesive interface and underlying dentin. However, the desirable action of the adhesive interface in promoting a tension absorber layer is doubtful, because the alumina-reinforced ceramics does not react to acid treatment and adhesive cementation as similar as the feldspathic ceramics and thus, certainly concentrates more tensions [28].

To achieve restorative treatment success, one should have a good treatment planning comprising study models mounted in semi-adjustable articulator and a good communication between the dentist and technician to allow greater treatment predictability through the interaction among the dentist, technician and patient [5, 18].

Conclusion

According to the evidences found in the literature reviewed, it can be concluded that ceramic laminates are an excellent esthetic solution for anterior teeth, because of the good optical properties of dental ceramics in addition to the very conservative treatment that returns the patient's health, wellness and harmonic smile.

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