

## REVIEW ARTICLE

# Veneer Thickness affects Color Reflection in IPS e.max press Ceramics: a Comprehensive review in Dentistry

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### ABSTRACT

Over the past decade ceramic restorations have become increasingly popular despite some of their shortcomings including brittleness, catastrophic failure and wearing of opposing teeth. Their popularity is attributed to their superior esthetic properties, biocompatibility and longevity. On the other hand, demand for tooth colored restorations has grown considerably during the last decade. Teeth color and contrast ratio is one of the methods used to compare opacity of all ceramic systems. The final color of the veneer depends on several factors. This article presents a literature review on effect of veneer thickness on color reflection in IPS e.max press ceramics. In this paper we want to determine factors affecting in color of lithium disilicate bases ceramics in prosthodontics. It is important to identify crucial factors in this phenomenon. New suggestions in prosthodontic introduced in this review. It seems this literature review cast light on hidden side of prosthodontics.

**Key Words:** Veneer, Color reflection, IPS e.max press ceramics

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## INTRODUCTION

Over the past decade ceramic restorations have become increasingly popular despite some of their shortcomings including brittleness, catastrophic failure and wearing of opposing teeth. Their popularity is attributed to their superior esthetic properties, biocompatibility and longevity [1-3].

Veneers go as far back as the late 1930s where they were temporarily used by actors during filming, at that time adhesive systems did not exist, therefore long term retention was not possible. Long term retention of veneers was later demonstrated in the early 1980s by using hydrofluoric acid etching in combination with silane coupling agents [4,5]. Tooth discolorations are classified into two main groups: Extrinsic and intrinsic discolorations. Extrinsic stains occur on the dental surfaces, whereas intrinsic stains are caused by the presence of chromogenic material within enamel or dentine. Fluorosis and tetracycline staining are the most common examples of intrinsic discoloration and the most difficult to mask by veneering [6]. The importance of final color on dental ceramics acceptance affects overall acceptance of ceramics and will guarantee the prosthodontics. So, the aim of current paper was to determine factors affecting in color of lithium disilicate bases ceramics in prosthodontics, Also, introduce the approaches in this phenomenon.

## CERAMIC SYSTEMS

Currently there are several types of ceramics available for the fabrication of ceramic restorations. Pressable ceramics (IPS Empress, Ivoclar AG, Liechtenstein) were first introduced in the early 1990s [1,

7]. To date 2, dental ceramics introduced to: the first generation of heat-pressed dental ceramics contains leucite as reinforcing crystalline phase. In the first composition, leucite is responsible for strengthening the ceramic, associated with the leucite resulting from the nucleation process (a phenomenon that occurs with increasing temperature), giving a higher flexural strength (120MPa) with the increased strength still not enough for extensive restorations. In the second composition, the high content of crystalline lithium disilicate enables a volume increase of up to 60%. The crystals generated are smaller than those created with the leucite reinforced ceramics and their presence improves the flexural strength of the material (350 MPa), allowing the design of fixed partial prostheses of up to three units [8].

The second generation is lithium disilicate-based [9]. Lithium disilicate glass-ceramics have been extensively studied. All studies seem to agree that the mechanisms leading to the crystallization of lithium disilicate in these systems are somewhat complex, due to the presence of nan sized crystal phases [10]. Today, many framework structures for prosthetic restorations are fabricated in Computer Aided Design-Computer- Aided Machining (CAD-CAM) procedures which mean that a major part in the working sequence is carried out by means of industrial machines [11].

#### **IPS e.max press ceramics**

The introduction of a high-strength lithium disilicate glass ceramic (IPS e.max Press) allowed the fabrication of anterior and posterior crowns without the need for veneering and the fabrication of thin anterior veneers. IPS e.max Press is based on the same material as IPS Empress 2 but with higher translucency, strength, and toughness. IPS e.max Press posterior crowns have been reported to have similar clinical performance as Procera All Ceram and metal ceramic crowns. The translucency of dental ceramics is affected by thickness, number of firings, luting agent, background shade, texture and illuminant [12].

#### **Color and Contrast Ratio**

The color of a tooth is determined by a combination of intrinsic and extrinsic colorimetric effects. The intrinsic properties color is associated with the reflection and absorption of light; with the extrinsic properties related to coloring materials interacting with enamel, such as coffee, tea, tobacco [13]. Factors such as enamel thickness, shape, surface texture, dominant color of dentin, double layer effect and light source may further complicate the visual perception of the various nuances of the whole tooth [14].

#### **What are the factors influence final color of the veneer?**

The final color of the veneer depends on three chief elements and their interaction with one another. These elements are: the color of the tooth/substructure, the type of ceramic material used and the resin cement selected. Combining the three is the means by which an optimal esthetic outcome can be realized [15, 16, 5, 17]. Enamel behaves like a translucent object, allowing the passage of light, which permit visualization of the dentin while also providing the scattering of light at a wavelength of blue through its hydroxyapatite crystals [14]. There is no ceramic dental product that can simultaneously display characteristics of opacity and translucency in a single material. Therefore, manufacturers have offered ceramics for infrastructure building, opaque ceramic coverage for the construction of the dentin and translucent glazes to be used in layering techniques [8]. The amount of dental reduction while performing the preparation determines the space required for the production of ceramic prostheses. Each ceramic system should ensure that this thickness does not compromise the emergence profile of the restorative work.

#### **Relationship between contrasts ratio and veneering**

Previously, Chu *et al* [13] investigated the relationship between the color difference of bilayer porcelain veneers over white and black backgrounds and their contrast ratios. A significant correlation was found between the contrast ratio and masking ability of the veneers. Another study by Antonson *et al* [18] reported a strong positive linear relationship between contrast ratio and thickness of all ceramic materials tested. For instance, Shokry *et al* [19] also demonstrated that as the total thickness (core/veneer) of IPS Empress and In-Ceram Spinal were increased, their L\* values decreased. They explained this phenomenon by stating that with thicker specimens an increase of absorption of incident light occurs and reduced quantity of light is reflected, thus lower L\* values are recorded.

#### **APPROACHES**

Traditionally, the visual perception of color is the most commonly used selection method in dentistry. Colorimeters and spectrophotometers have been used in dentistry for the determination, quantification and comparison of color in the industrial manufacture of materials. There are several approaches to masking discoloration. Mild stains can be removed by vital bleaching. However, this may necessitate postponing the final restoration for at least 24 hours as it has been recognized that bleaching with

hydrogen peroxide compromises the resin bonding [20]. The evidence within the literature indicates that masking of heavy stains such as fluorosis and tetracycline discoloration requires the use of opaques, opaque luting cements or tints. Another approach is the usage of opaque cores including alumina or zirconia substructure. When that is done, the resulting veneer becomes opaque and lifeless and esthetics is compromised [21-24].

The other possible solution to the problem of heavily stained teeth is to increase the thickness of the veneer from the standard 0.75 mm thickness to 1.0 – 1.5 mm, since it appears that the thickness of the material influences its opacity which in turn may increase its masking ability. Further reduction of the labial and interproximal surfaces may provide additional space for the veneer which allows more leeway for color correction [23] but this might result in dentine exposure and consequently sensitivity after cementation. Recently, different ceramic systems designed for porcelain veneers present varying degrees of translucency. The thickness and shade of lithium disilicate ceramic affect its translucency. Shade affects translucency parameter less than thickness [12]. Also, the type and shade of resin cement and the thickness and shade of the ceramic all influenced the resulting optical color of laminate restorations where the colors of the same shades of different resin cement systems were found at different coordinates in the CIE L\*a\*b\* system [25].

## CONCLUSION

The optical behavior of a ceramic restoration is determined by the combination of tooth structure color, ceramic layer thickness, and cement color. Previous studies have demonstrated that underlying tooth structure has a primary influence on the appearance of definitive ceramic restorations. If a ceramic restoration is placed on dark underlying tooth structure, the color beneath the ceramic might result in discoloration and shadowing of the restoration. Contrast ratio and masking ability are affected by the type as well as the thickness of the ceramic used. This paper introduced new methods instead of old time consuming and costly methods which have been used in implant framework in dentistry. Because lithium disilicate is the most preferred material in dentistry and on the other hand no existing research on effects of veneer thickness affects color reflection in IPS e.max press ceramics.

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