

# **The Effect of Bleaching on Color, Surface Roughness and Shear Bond Strength of Two Different Ceramic Materials.**

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## ***Dedication***

*This work is dedicated to my family  
for their continuous love, support  
and great care.*

*My Father and Mother have been  
the source of encouragement  
and guidance.*

*My beloved fiancée for her  
Understanding, great  
help and support.*

# *Contents*

	<i>Page</i>
List of Figures.....	I
List of tables.....	III
Introduction.....	1
Review of literature.....	3
Aim of the study.....	35
Materials and methods.....	36
Results.....	64
Discussion.....	84
Summary and conclusion.....	92
References.....	94
Arabic summary	

# *List of Figure*

	<b>Page</b>
Figure 1: VITA VMK Master 1M2. ....	36
Figure 2: IPS e.max CAD. ....	36
Figure 3: Zoom bleaching agent. ....	36
Figure 4: Phosphoric acid. ....	36
Figure 5: Variolink Veneer. ....	36
Figure 6: Porcelain etch. ....	37
Figure 7: Silane coupling agent. ....	37
Figure 8: Excite bonding agent. ....	37
Figure 9:Diagram of block assembly. (a) ceramic disc,(b) central incisor,(c) clear resin,(d) PVR tube.....	39
Figure 10: Decapitated tooth embedded in clear acrylic resin in a PVR plastic tube. ....	39
Figure 11: Teflon mold for fabrication of ceramic discs of 5mm diameter and 2mm thickness. ....	43
Figure12 : Mold with feldspathic disc before correction(a) and after corection(b). ....	43
Figure13 : Mold for ceramic discs sized 0.7mm by7mm. ....	44
Figure14 : The plastic plunger. ....	44
Figure 15: Cerec InLab MC XL.....	45
Figure 16: Optical impression.....	46
Figure 17: Determining the preparation axis. ....	47
Figure 18: Editing the mold margins. ....	47
Figure 19: Milling preview. ....	48
Figure 20: Choosing IPS. e.max CAD from the dialogue box. ....	48
Figure21 : Selecting the milling machine unit. ....	49
Figure 22: Step bur and cylinder pointed bur. ....	49
Figure23 : Blue IPS e.max CAD Ceramic disc after milling.....	50
Figure 24: IPS e.max disc after crystallization. ....	51
Figure 25: Ceramic disc etching. ....	51
Figure 26: Application of silane coupling agent.....	52
Figure 27: Etching of enamel surface for 30 seconds.....	53
Figure 28: Application of bonding agent. ....	53
Figure 29: Application of Variolink Veneer. ....	54
Figure 30: Loading device. ....	54
Figure 31: Curing the sample.....	55

Figure 32: Ceramic disc after cementation to enamel surface .....	55
Figure 33: Universal testing machine. ....	56
Figure 34: Custom made mono-beveled chisel.....	57
Figure 35: Easy shade probe tip in contact with specimen for color measurements.....	58
Figure 36: Screen displaying the color coordinates.....	59
Figure 37: Stereomicroscope. ....	60
Figure38 : Sample under stereomicroscope.....	60
Figure 39: Zoom bleaching gel kit.....	62
Figure 40: Application of Zoom gel. ....	62
Figure 41: Zoom Light emitting diode.....	63
Figure 42: Mean values of shear bond strength for feldspathic porcelain. ...	65
Figure 43: mean values of shear strength for lithium disilicate porcelain. ...	66
Figure 44: Mean values of shear bond strength before bleaching for feldspathic and Lithium disilicate.....	67
Figure 45: Mean values of shear bond strength for feldspathic and lithium disilicate after bleaching. ....	68
Figure 46: Mean values of change in shear bond strength for feldspathic and lithium disilicate.....	70
Figure 47: Mean values of surface roughness for feldspathic porcelain. ....	71
Figure 48: Mean values of surface roughness for lithium disilicate porcelain. ....	72
Figure 49: Mean values of surface roughness for feldspathic and lithium disilicate before bleaching. ....	73
Figure 50: Mean values of surface roughness for feldspathic and Lithium disilicate after bleaching. ....	74
Figure 51: Mean values of change in surface roughness for feldspathic and lithium disilicate.....	76
Figure 52: Estimated means of $L^*$ .....	79
Figure 53: Estimated means of $a$ .....	79
Figure 54 : Estimated means of $b^*$ .....	80
Figure 55: Mean values of change in $\Delta E$ for feldspathic and lithium disilicate.....	83

# *List of tables*

	<b>Page</b>
Table 1: List of materials .....	36
Table 2: Experimental factorial design for tested Samples: .....	40
Table 3: Paired t-test for shear bond strength measurement for feldspathic porcelain.....	65
Table 4: Mean and standard deviation values of shear bond strength for feldspathic porcelain. ....	65
Table 5: Paired t-test for shear bond strength for lithium disilicate porcelain. ....	66
Table 6: Mean and standard deviation values of shear strength for lithium disilicate. ....	66
Table 7 : t-test for shear bond strength before bleaching for feldspathic and lithium disilicate.....	67
Table 8 Mean and standard deviation of shear bond strength before bleaching for feldspathic and lithium disilicate.....	67
Table 9: t-test for shear strength after bleaching for feldspathic and lithium disilicate. ....	68
Table 10: Mean and standard deviation of shear bond strength for feldspathic and Lithium disilicate after bleaching. ....	68
Table 11: t-test for shear strength for feldspathic and lithium disilicate .....	69
Table 12: Mean and standard deviation of change in shear strength for feldspathic and Lithium disilicate. ....	69
Table 13: paired t test for shear strength for feldspathic .....	71
Table 14: Mean and standard deviation values of roughness for feldspathic. ....	71
Table 15: Paired t-test for surface roughness for lithium disilicate porcelain. ....	72
Table 16: Mean and standard deviation values of surface roughness lithium disilicate. ....	72
Table 17: t-test for surface roughness for feldspathic and lithium disilicate before bleaching.....	73
Table 18: Mean and standard deviation of roughness before bleaching for feldspathic and Lithium disilicate.....	73
Table 19: t-test for roughness after bleaching for feldspathic and lithium disilicate. ....	74



Table 20: Mean and standard deviation of surface roughness for feldspathic and lithium disilicate after bleaching. ....	74
Table 21: t-test for surface roughness for feldspathic and lithium disilicate. ....	75
Table 22: Mean and standard deviation of change in surface roughness for feldspathic and lithium disilicate. ....	75
Table 23: Means, standard deviations of L*, a*, b* for feldspathic porcelain before and after bleaching. ....	77
Table 24: Means, standard deviations of L*, a*, b* for lithium disilicate porcelain before and after bleaching. ....	77
Table 25: Multivariate Test. ....	78
Table 26: Tests of Between-Subjects Effects. ....	78
Table 27: $\Delta L^*$ , $\Delta a^*$ , $\Delta b^*$ , means and standard deviations for feldspathic and lithium disilicate. ....	81
Table 28: $\Delta L^*$ , $\Delta a^*$ , and $\Delta b^*$ of feldspathic and lithium disilicate. ....	82
Table 29: t-test for Delta e measurement for feldspathic and lithium disilicate. ....	82
Table 30: Mean and standard deviation of change in color ( $\Delta E$ ) for feldspathic and Lithium disilicate. ....	82



## **INTRODUCTION**

Patients often seek dental treatment for esthetic problems such as discolored teeth through various methods, All-ceramic restorations and bleaching remains the major interest in patients concerned with esthetics.

Dental ceramic materials have demonstrated extremely desirable properties, including biocompatibility, esthetics & chemical resistance.<sup>(1,2)</sup> The popularity of all ceramic dental restorations has increased in recent years due to their superior esthetic appearance and metal-free structure.<sup>(3)</sup> Currently a wide variety of all-ceramic dental restorations are provided using various ceramics systems.<sup>(4)</sup>

Since carbamide peroxide home bleaching was introduced in the 1980s, this treatment has become a popular and conservative alternative for patients seeking improved esthetics in a relatively short period of time.<sup>(5,6)</sup> During crown cementation, a microscopic, cement-filled gap is formed between the prepared tooth and the restoration margin. If a fixed restoration is subjected to vital tooth bleaching, any exposed cement margin will be exposed to the bleaching agent as well.<sup>(5,6)</sup> The possibility exists that the bleach could deteriorate or dissolve the cement, creating a void where bacteria could proliferate.<sup>(5)</sup> As a result of this void, bond strength could be deteriorated between the ceramics and tooth structure. Vital tooth bleaching could affect the surface texture of the ceramic used.

Given the fact that over 40% of the populations have at least one dental restoration, the effects of different bleaching treatments on dental materials have received much attention. However, the effects of bleaching agents on restorative materials remain controversial.<sup>(7)</sup>

If cement dissolution exposes the prepared tooth surface, penetration of peroxide into the abutment tooth could result in pulpal reactions and patient discomfort.<sup>(5)</sup>

It remains a major concern if bleaching would affect some important characteristics of ceramics including color, surface roughness and shear bond strength.

## **REVIEW OF LITRATURE**

In recent years, trends for esthetic dentistry surprisingly increased. The demands of patients for tooth-colored restorations and the availability of new types of dental ceramics have driven increased use of ceramic materials in a variety of restorative situations. <sup>(8,9)</sup>

Full veneers restoration treatment is potentially invasive and requires considerable reduction of tooth structure, and hence laminates and metal-free restorations have been introduced. Porcelain veneers are thin ceramic laminates that are bonded to the labial surface of the anterior teeth. <sup>(10)</sup> also esthetics, strength, biocompatibility and easy-processing are important issues regarding these types of restorations, recognizing the bond strength of each material has been of great importance for dental practitioners. <sup>(11)</sup> Different types of material have been utilized to fabricate these restorations; Low-fused feldspathic ceramics, reinforced ceramics and laboratory composites are some of the most prominent. <sup>(12)</sup> The primary advantage of a ceramic restoration is the increase in depth of translucency and light transmission, either deeper into or across the entire restoration. This allows the ceramist and restorative dentist to provide the patient with a natural and vital-looking restoration. <sup>(13)</sup>

### **Historical Background of Ceramics:**

At the end of the 19<sup>th</sup> century, all-ceramic restorations, called Jacket crowns were fabricated by firing a feldspathic ceramic material on a die prepared with platinum foil. As the only esthetic restorative modality found at that time, <sup>(14)</sup> Jacket crowns failed to gain popularity due to its low strength and high probability of fracture as well as its poor marginal seal. Porcelain

jacket crowns later on were replaced by metal-ceramic restorations which gained wide spread.

In the early 1930 porcelain veneers were first introduced by **Dr. Charles Pincus** using denture adhesive to retain the veneers. In 1937 acrylics were introduced which had a large impact and replaced porcelain veneers. Soon the disadvantages of acrylic resins were realized which are increased wear, high permeability leading to discoloration and leakage. By the time the adhesion techniques and enamel bonding was introduced, composite pioneered the use of Veneers.<sup>(15,16)</sup>

In the early 1950s, the first attempts were made to add leucite to porcelain formulations to elevate the coefficient of thermal expansion and allow their fusion with gold alloys. Following the introduction of feldspathic porcelain crown by **Land**, the demand for nonmetallic and biocompatible restorative materials increased for clinicians and patients.<sup>(17)</sup> In the 1960s, fusion of ceramics to gold alloys was introduced to dentistry successfully.

Using metal-ceramic restoration may lead to compromised esthetics especially in anterior teeth because of limited translucency of opaque metal substructure. In laminates the absence of metal is essential to allow the light transmission through the restoration and permit a perfect match with natural teeth.<sup>(18)</sup> The metal substructure may also show through the thin gingival areas which may compromise esthetics in the anterior teeth. Demand for more esthetically pleasing dental restoration and public fears about the adverse effects of dental metals and alloys have lead to the increased use of ceramics.<sup>(19)</sup>

In 1965, **McLean** pioneered the concept of adding Alumina to feldspathic porcelain to improve mechanical and physical properties.<sup>(20)</sup> In

1968, **MacCulloch**, in conjunction with the **Pilkington Glass Company**, was the first to use glass ceramic veneers to replace porcelain pin teeth.<sup>(21)</sup>

Acid etching of enamel to bond metal-ceramic fixed partial dentures to lower teeth was conceived by **Rochette**<sup>(22)</sup> in 1973. The concept of bonding composite resin to acid-etched porcelain was first reported by **Simonsen and Calamia**<sup>(23)</sup> in 1983, and the fabrication of porcelain veneers with this system was reported by **Horn**<sup>(24)</sup> in the same year. The direct bonding of porcelain to tooth structure remains one of the most significant advances of the 20<sup>th</sup> century in restorative dentistry.

Specialized porcelains have since been developed for porcelain laminate veneers. The use of ceramic etching and silane coupling agent in addition to phosphoric acid etching to enamel surface improved the micromechanical retention and bonding of laminates to the tooth surface using resin based composites.<sup>(25)</sup> This enabled practitioners to adopt a much more conservative approach to tooth restoration.

It is no exaggeration to state that the last century saw a revolution in dental esthetics. In the 21<sup>st</sup> century, the challenge of producing high-strength ceramics without sacrificing translucency may be solved.<sup>(26)</sup>

## **Porcelain Laminate Veneers:**

Porcelain laminate veneers (PLVs) can be used in a broad range of esthetic restorative situations, and countless patients have benefited from their advantages over traditional crowns.<sup>(27,28)</sup> All ceramic porcelain laminate veneers can provide some of the most esthetically pleasing restoration currently available, they promote the conservation of natural tooth structure and eliminate the risk of a negative periodontal response whenever the finish line is supragingival.