Ain shams university

Faculty of dentistry

Effect of Different Illuminants on the Final Color of All-Ceramic & Hybrid Ceramic Laminate Veneers

Thesis submitted to fixed prosthodontics department, Faculty of Dentistry, Ain shams university for partial fulfillment of the requirements of the Master degree in fixed prosthodontics

By

Mohamed Hamed El-Fatatry

B.D.S; Sixth October University (2009)

Supervisors:

Prof. Dr /Amina Mohamed Hamdy

Professor of fixed prosthodontics

Crown and bridge department

Faculty of Dentistry

Ain Shams University

Dr /Ayman Galal El Dimeery

Lecturer of fixed prosthodontics

Crown and bridge department

Faculty of Dentistry

Ain Shams University

Faculty of dentistry
Ain shams university
2017

"فَتَعَٰلَى ٱللَّهُ ٱلۡمَلِكُ ٱلۡحَقُّۗ وَلَا تَعۡجَلۡ
بِٱلۡقُرۡءَانِ مِن قَبۡلِ أَن يُقۡضَىٰٓ إِلَيۡكَ وَحۡيُهُۥۖ
وَقُل رَّبِّ زِدۡنِي عِلۡمٗا ﴿١١٤﴾"

سورة طه 114

Supervisors:

Dr /Amina Mohamed Hamdy

Professor of fixed prosthodontics

Crown and bridge department

Faculty of Dentistry

Ain Shams University

Dr /Ayman Galal El Dimeery

Lecturer of fixed prosthodontics

Crown and bridge department

Faculty of Dentistry

Ain Shams University

Acknowledgement

First and foremost, thanks are due to ALLAH the Most Gracious and the Most Merciful.

I would like to express my deepest gratitude and appreciation to Prof. Dr. Amina Mohamed Hamdy, Professor of Crown and Bridge department, Faculty of Dentistry, Ain Shams University for her precious efforts, meticulous advice, and her valuable comments.

I would like also to express my heartful thanks and sincere gratitude to Dr. Ayman Galal El Dimeery, Lecturer of Crown and Bridge department, Faculty of Dentistry, Ain Shams University for his continuous support, patience and motivation and his guidance helped me in all the time of research and writing of this thesis.

Dedication

I must express my very profound gratitude to:

My parents for providing me support & continuous encouragement, throughout my years of study and through the process of researching & writing this thesis.

The accomplishment would not have been possible without them.

Thank you.

List of Contents

List of Tables 2

List of Figures 5

Introduction 7

Review of Literature..... 9

Statement of Problem..... 37

Aim of the study..... 38

Hypothesis..... 39

Materials and Methods..... 40

Results..... 67

Discussion..... 90

Limitations..... 99

Summary 100

Conclusions 103

References 104

Appindex 113

List of Tables

Table 1: List of ceramics used within the study. 40

Table 2: Mechanical properties of VITA ENAMIC [35] 41

Table 3: Chemical composition of the fine – structure feldspar ceramic network [35] 42

Table 4: Chemical composition of the polymer network [35] 42

Table 5: Mechanical properties of VITA SUPRINITY [38] 43

Table 6: Chemical composition of the Zirconia Reinforced Lithium Silicate Glass – Ceramic (VITA SUPRINITY) [38] 44

Table 7: Mechanical properties of IPS E - max CAD [33] 45

Table 8: Chemical composition of the lithium disilicate glass ceramic (IPS E - max CAD) [33] 45

Table 9: Light curing composite resin material. 46

Table 10: Vita ceramics acid etch 47

Table 11: Ultradent® Silane Coupling agent 48

Table 12: Variolink® Veneer light curing resin cement 49

Table 13: Firing parameters for crystallization of VITA SUPRINITY 54

Table 14: Firing parameters for crystallization of IPS e - max CAD 55

Table 15: Surface treatment of ceramic discs for bonding. 64

Table 16: Descriptive statistics of color difference (ΔE) values 68

Table 17: The interaction between cementation and illuminants and ceramic materials on the color difference with: 69

Table 18: The mean, standard deviation (SD) values of Color change (ΔE) of the three ceramic materials used in the study before and after cementation with illuminant shift. 71

Table 19: The mean, standard deviation (SD) values of Color difference (ΔE) of the three ceramic materials separately with illuminant shifting. 72

Table 20: The mean, standard deviation (SD) values of Color difference (ΔE) of the three ceramic materials with illuminant shifting before and after cementation. ... 73

Table 21: The mean, standard deviation (SD) values of Color difference (ΔE) before and after cementation with illuminant shifting. ... 74

Table 22: Descriptive statistics of (L*) values ... 75

Table 23: Mixed ANOVA results for the effect of illuminants, ceramic materials and cementation and the interaction between cementation and illuminants on the (L*) value: ... 76

Table 24: Mean, standard deviation for the effect of ceramic materials regardless of illuminant on the (L*) value: ... 77

Table 25: Mean, standard deviation for the effect of illuminants regardless of ceramic materials on the (L*) value: ... 78

Table 26: Mean, standard deviation for the effect of cementation on the (L*) value: ... 79

Table 27: Descriptive statistics of (a*) values: ... 80

Table 28: Mixed ANOVA results for the effect of illuminants, ceramic materials and cementation and the interaction between cementation and illuminants on the (a*) value: ... 81

Table 29: Mean, standard deviation for the effect of ceramic materials regardless of illuminant on the (a*) value: ... 82

Table 30: Mean, standard deviation for the effect of illuminants regardless of ceramic materials on the (a*) value: ... 83

Table 31: Mean, standard deviation for the effect of cementation on the (a*) value: ... 84

Table 32: Descriptive statistics of (b*) values: ... 85

Table 33: Mixed ANOVA results for the effect of illuminants, ceramic materials and cementation and the interaction between cementation and illuminants on the (b*) value: ... 86

Table 34: Mean, standard deviation for the effect of ceramic materials regardless of illuminant on the (b*) value: ... 87

Table 35: Mean, standard deviation for the effect of illuminants regardless of ceramic materials on the (b*) value: 88

Table 36: Mean, standard deviation for the effect of cementation on the (b*) value:..... 89

List of Figures

Figure 1: VITA ENAMIC block 41

Figure 2: VITA SUPRINITY block 43

Figure 3: E-max CAD block 44

Figure 4: 3M™ ESPE™ Filtek™ Z350 XT, A1 Dentin Shade 46

Figure 5: Vita Ceramics Etch, dropper bottle, 6 ml. 47

Figure 6: Ultradent® Silane Coupling Agent, 1.2 ml. syringes with the Black Mini® Brush tip 48

Figure 7: Variolink® veneer, medium value 0, Ivoclar Vivadent 49

Figure 8: Automatic Section Saw (8") IsoMet 4000 50

Figure 9: Sectioning of Vita Enamic Block 51

Figure 10: Sectioning of Vita Suprinity Block 51

Figure 11: Sectioning of IPS e-max CAD Block 52

Figure 12: Calibration of ceramic sample thickness 52

Figure 13: Vita Enamic samples (No firing was done) 53

Figure 14: Vita Suprinity samples (After firing) 54

Figure 15: IPS E-max CAD samples (After firing) 55

Figure 16: Finishing and polishng kit 56

Figure 17: Ultra Sonic Cleaner 57

Figure 18: Teflon mold 57

Figure 19: Teflon mold on a clean glass slab. 58

Figure 20: The composite resin sample 59

Figure 21: Composite resin samples 60

Figure 22: Calibration of composite resin sample thickness 60

Figure 23: Agilent Cary 5000 spectrophotometer 61

Figure 24: Simplified diagram demonstrate the direction of the beam in the spectrophotometer during sample color measurement 62

Figure 25: Ceramic and composite resin samples after cementation 66

Figure 26: Bar chart representing ΔE of each ceramic material before and after cementation with illuminant shift. 71

Figure 27: Bar chart representing mean (ΔE) of the three ceramic materials with illuminant shifting 72

Figure 28: Bar chart representing mean (ΔE) of the illuminant shifting 73

Figure 29: Bar chart representing mean (ΔE) value before and after cementation regardless of material 74

Figure 30: Bar chart representing mean (L*) value of the three ceramic materials regardless of illuminant and cementation 77

Figure 31: Bar chart representing mean (L*) value of the three illuminants regardless of ceramic materials and cementation 78

Figure 32: Bar chart representing mean (L*) value before and after cementation regardless of illuminant and material 79

Figure 33: Bar chart representing mean (a*) value of the three ceramic materials regardless of illuminant and cementation 82

Figure 34: Bar chart representing mean (a*) value of the three illuminants regardless of ceramic materials and cementation 83

Figure 35: Bar chart representing the effect of cementation on the mean (a*) value regardless of material and illuminant 84

Figure 36: Bar chart representing mean (b*) value of the three ceramic materials regardless of illuminant and cementation 87

Figure 37: Bar chart representing mean (b*) value of the three illuminants regardless of ceramic materials and cementation 88

Figure 38: Bar chart representing the effect of cementation on the mean (b*) value regardless of material and illuminant 89

Figure 39: The spectral power of distribution of the standard illuminants used in the study [5] 92

Introduction

Introduction

Technological advances have allowed esthetically successful treatments, especially in the anterior region. With the improvements in ceramic systems and resin cements, it is possible to create restorations with optical properties similar to those of the natural tooth [(1)]. Porcelain laminate veneer (PLV) restorations have an increasing popularity due to their conservation of tooth structure, their superior optical properties, increased translucency and improved esthetics [(2)]. A significant challenge in esthetics is to match the optical properties of natural teeth with restorations.

Proper shade selection is a subjective assessment that depends on illumination, color of the surroundings, and the experience of the observer. The translucency of (PLV) restorations adds another level of complexity to the color-matching process because ceramics allow more light to enter and scatter, which means that the underlying substrates have a significant influence on the final color [(1)].

Reflected and transmitted visible light decides the perceiving of color of an object, and the object can only reflect and transmit the spectrum of light that shines on it. Since lightings show varied source-dependent spectral power distributions (SPDs), the nature of the luminous source influences the behavior of color, as during color selection, a single illuminant can interfere with the observed color, which appears to be color matched under one illuminant but unmatched under different illuminants, this phenomenon is called metamerism which is probably the largest single cause of industrial

shade matching problems [4-5]. There seems to be necessity to observe the color with different luminous sources; therefore, the impact of illuminating lights on the color of dental substances is a significant clinical concern [3].

The daylight is an ideal light source but, it cannot be standardized easily due to its variability by weather, time of the day, and season of the year. The Commission Internationale de l'Eclairage (CIE) mathematically defined ambient lights into standard illuminant D65 which represents a phase of the daylight which is commonly used in visual shade matching, illuminant A represents an incandescent or tungsten light, and illuminant F2 represents the spectral quality of the most common fluorescent lamp (cool white fluorescent) [6].

Few publications found on the influence of changes in illuminants on the color of the recent all - ceramic materials like Vita Suprinity, Vita Enamic and IPS e - max CAD. The current study attempt to measure the difference in color of different all - ceramic and hybrid ceramic laminate veneers under different illuminants before and after cementation.

Review Of Literature