Effect of the Outer Composite Layer Thickness in Different Layering Techniques on the Color of Dark Shade Composite Resin Restoration

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BY

Amira Salah El Said El Najjar

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Supervisors

Dr. Khaled Aly Nour

Associated professor, Department of Operative Dentistry
Faculty of Dentistry, Ain Shams University

Dr. Ahmed Ahmed Laithy Hassan

Lecturer,Department of Operative Dentistry
Faculty of Dentistry, Ain Shams University

Dr. Mohammed Nasser Mohammed Anwar

Lecturer,Department of Operative Dentistry
Faculty of Dentistry, Ain Shams University

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Dedication

To *my* ***lovely husband*** *and my son* ***Adam****:*

I would like to dedicate this to you my lovely husband. I wouldn't have reached this point in my life without your love, help and support. Thank you for taking good care of me and helping me become the person I am today.

Amira Salah El Said El Najjar

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Introduction

Composite resins tend to produce natural looking restorations. They are relatively translucent and they provide a “chameleon” effect in small restorations [1]. Various levels of translucency have been developed to allow replication of the combined optical properties of dentin and enamel. A particularly challenging situation involves Class IV restorations, which have no backing tooth structure. Without an appropriate level of dentinal opacity, even the most ideal shade of composite may appear too gray, because the relatively translucent composite is unable to mask the dark background of the oral cavity [2].

Clinicians have devised “layering” techniques in which more translucent materials are placed over a more opaque composite in an effort to create depth from within the restoration [3]. Several manufacturers now offer expanding lines of "enamel,” “dentin” and/or “body” shade categories with different levels of opacity and translucency. There are many techniques for layering procedure .Using different shades & thicknesses of enamel & dentin layers to mimic the 3D appearance of natural teeth.

VOCO (VOCO GmbH, Germany) introduced an anterior composite resin restorative system called Amaris. The Amaris system incorporates only 2 steps. The first step is the selection and placement of the appropriate opaque composite layer (From O_1 to O_5) replacing dentin while the second step is the selection and placement of a translucent composite layer replacing enamel that serves to lighten (T_L), darken (T_D), or to complement (T_N) the color of the opaque shade. Therefore, theoretically speaking according to the manufacturer’s instructions, each color of the supplied shade guide can be obtained by three different layering techniques: T_N + Proper opaque shade, T_L + Later darker opaque shade, or T_D + Previous lighter opaque shade, and the idea behind the latter two additional layering techniques is to allow the clinician to correct the overall color in case a wrong opaque shade was selected.

By this essence, the Amaris system allows what is called active shade management and modification during the composite resin layering procedure. The manufacturer recommended a thickness of 0.5 mm of the outer T_N layer in the first layering technique; however, it did not provide specific guidelines for the required optimum thickness of the outer translucent layer in each case scenario of the two additional layering techniques for shade correction. Therefore a point worthy of research is to investigate the effect of

variation of the outer translucent composite layer thickness in those two additional layering techniques on the final color of the composite restoration.

Review of Literature

The direct composite resin restoration represents a challenge for all clinicians. These restorations require knowledge of the structures, materials, and artistic skill. In the esthetic zone, composite resin bonding procedures are considered the most conservative and least invasive technique to return missing, diseased, and unsightly tooth structure to enhanced color, form, and function. The attractiveness and popularity of composites are easy to explain because these restorations have excellent esthetic potential, and a reasonable fee [4,5]. But many challenges are facing clinicians in esthetic restoration reproduction including the reproduction of a natural color transition from tooth to restoration, masking the intraoral background, a translucent incisal edge, and natural surface texture. So mastering anterior direct composite restorations is a necessity for the contemporary clinician who appreciates and understands the art and science of cosmetic dentistry.

The phenomenon of color is a psychophysical response to the physical interaction of light energy with an object and the subjective experience of an individual observer [6]. Different colors result from the multiple ways in which an object interacts with light, absorption and reflection being the most important events for color formation [4]. Light is an electromagnetic radiation and mostly moves as waves. The white light that is seen by human eyes called as "visible" light (380 nm to 780 nm) [7]. There are three things that can happen to a light wave. It can be reflected, absorbed, or transmitted. If all of the light is reflected, the object appears white [8]. Every opaque object that you see around you is receiving light or is receiving the three primary colors red, green, and blue-violet in some ratio. Some of these objects reflect all of the light they receive and others absorb it almost totally. Most "opaque" objects absorb partially and reflect the rest. The dominant wavelength reflected back to your eye is the perceived color of the object. White paper reflects almost all visible light rays. Black objects absorb most of the light so nothing is reflected back to your eyes. A perfect black body is basically unchanged by shining the light on it. A yellow object (like a banana), when illuminated by the three primary colors, will actually absorb the blue-violet and reflect back the red and the green which when mixed will appear as yellow [9]. The most popular method for describing the color is the Munsell system (Fig. 1). The color tree is a representation of the tridimensional organization of colors within the Munsell system. The Munsell color solid can be likened to a sphere or a