Surface Texture and Potential Accumulation of Streptococcus mutans on Composite resin Surface.

Thesis

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BY

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Dedicated

To my great parents for their prays
To my wonderful family for their love and kindness
To my wife for her patience and support
To my precious sons Adam & Noah for sake of their future

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Composite restorations are widely used now by many dentists all over the world. With enhanced mechanical and esthetical properties, composite is not any more avoided in posterior restorations as well as anterior ones. The ideal composite restoration should follow the rules of mechanical and esthetical considerations, as well as biocompatibility to oral environment.

Most of the recent researches now are more interested in surface properties of composite, as the improving of bulk properties has reached reasonable results. Unfortunaly, many dentists do not pay that attention to the surface while manipulation of composite filling, they pay most of their attention to the retention, resistance and appearance of the filling with little or sometimes no check to the surface roughness. With increasing demands of highly refined carbohydrates, the hazards of streptococcus mutans has increased too, and the accumulation of bacterial colonies on tooth surface as well as restoration surface is just the begin of a new carious lesion.

In restorative dentistry, one of the main goals is to increase the lifetime of dental restorations. The clinical success of resin composites is related to the appearance and surface

smoothness; however the replacement frequency of tooth-colored restorations is mostly because of secondary caries and discoloration **(Strassler and Bauman, in 1993, Mjör et al., in 2000, and Jefferies, in 2007).** It is essential to obtain adequate smoothness and gloss for a successful resin composite restoration. Moreover, there should also be a healthy relationship between the restoration and the adjacent dental tissues. The inadequate finishing/polishing of resin composites leads to increased plaque retention, gingival inflammation, discoloration and also leads to patient discomfort **(Weitman and Eames, in 1975, Hachiya et al., in 1984, Quirynen et al., in 1990, Bollen et al., in 1997, and Aykent et al., in 2010).**

Jones et al., in 2004, reported that a surface roughness of 0.3 μm can be detected by the tip of the patient's tongue. Proper contour, smoothness and high gloss can produce the desired appearance of natural tooth structure desired by patients **(Cenci et al., in 2008).**

Many dentists, neglect doing a proper polishing of composite, some do not use the celluloid matrix while setting, others may use a carbide bur or diamond stone to abrade a high spot of the filling after polishing, and many may just add some

bonding agent to the surface of the filling and consider that mission is accomplished. This study is trying to see how these procedures could affect the surface texture of the composite filling, and make it more or less liable to accumulation of Bacteria on its surface.

A- Composite evolution and types.
B- Finishing and polishing procedures of composite.
C- Methods of composite surface roughness measurements.
D- Role of *Streptococcus mutans* in dental decay.
E- *Streptococcus mutans* correlation with surface roughness
F- Culture media for the growth and enumeration of *Streptococcus mutans*

A- Composite evolution and types.

To improve the physical characteristics of unfilled acrylic resins, Bowen developed a polymeric dental restorative material reinforced with silica particles. The introduction of this filled resin material in 1962 became the basis for the restorations that are generically termed composites. Basically, composite restorative materials consist of a continuous polymeric or resin matrix in which inorganic filler is dispersed. This inorganic filler phase significantly enhances the physical properties of the composite. Composites are usually divided into three types based primarily on the size, amount, and composition of the inorganic filler: (1) conventional composites, (2) microfill composites, and (3) hybrid composites. More recent changes in composite composition have resulted in several other hybrid type categories, including flowable, packable, and nanofill composites. The microfill or

"polishable" composites were designed & introduced in the late 1970s to replace the rough surface characteristic of conventional composites with a smooth lustrous surface similar to tooth enamel. Instead of containing the large filler particles typical of the conventional composites (approximately 8 mm.), microfill composites contain colloidal silica particles whose average diameter is (0.01 to 0.04 mm). In an effort to combine the favorable physical and mechanical properties characteristic of conventional composites with the smooth surface typical of the microfill composites, hybrid composites were developed. an inorganic filler content of approximately 75% to 85% by weight. The filler is typically a mixture of microfiller and small filler particles that results in a considerably smaller average particle size (0.4-1 mm) than that of conventional composites. Nanofill composites contain filler particles that are extremely small (0.005-0.01 μm) resulting in good physical properties and esthetics. The small primary particle size also makes nanofills highly polishable. **(Roberson, in 2006).**

The composition of resin-based dental composites has evolved significantly since the materials were first introduced to dentistry more than 50 years ago. Until recently, the most

important changes have involved the reinforcing filler, which has been purposely reduced in size to produce materials that are more easily and effectively polished and demonstrate greater wear resistance. The latter was especially necessary for materials used in posterior applications, but the former has been important for restorations in all areas of the mouth. Current changes are more focused on the polymeric matrix of the material, principally to develop systems with reduced polymerization shrinkage, and perhaps more importantly, reduced polymerization shrinkage stress, and to make them self adhesive to tooth structure. **(Kalpdohr & Moszner 2005 – Chen 2010)**

B- Finishing and polishing procedures of composite.

Based on this review, the range in surface roughness of different intraoral hard surfaces was found to be wide, and the impact of dental treatments on the surface roughness is material-dependent. Some clinical techniques result in a very smooth surface (compressing of composites against matrices), whereas others made the surface rather rough (application of hand instruments on gold). These findings indicated that every