بسم الله الرحمن الرحيم

(قالوا سبحانك لا علم لنا إلا ما علمتنا إنك أنت العليم الحكيم)

صدق الله العظيم

" الأية ٣٢ من سورة البقرة "

Effect of the Finish Line Design on the Marginal Accuracy and Internal Adaptation of Two Esthetic Restorative Materials

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Dedication

To my wonderful mother and father, May God repay you for all what you have done for me.

To the one who shared my difficult times, to my dear wife your love ,support and understanding made this accomplishment possible, I love you.

To my grandfather, May God repay you for all what you have done for me.

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Introduction

During the last decade the demand for aesthetic nonmetallic biocompatible dental restorative materials with high strength, natural color, good wear resistance, marginal integrity and ease of fabrication has increased markedly.

With the introduction of new composite resins, including fiber-reinforced systems, the restoration or replacement of a single tooth or multiple teeth with a fiber reinforced crown or metal-free partial dental prosthesis is now an option.(1)

The CEREC system is a computer-assisted design/computer-assisted manufacturing (CAD/CAM) system designed for the fabrication of indirect restorations.(2)

Paradigm MZ 100 is the recently introduced material for use with the Cerec 3 system, the material contains 85 wt% ultrafine zirconia-silica ceramic particles that reinforce a highly crosslinked polymeric matrix. It is indicated for inlay, onlay, veneer and full crown restorations.(3)

The SR Adoro is a microfilled light/heat cured composite, it has been used in clinical studies since 2001 for full and partial coverage restorations. The advantages of this material over other composite materials are limited abrasion, good polishability, durable surface gloss, ease of manipulation, high translucency, good stability and harmonious shade.(4)

Marginal accuracy is an important factor in the success and longevity of an indirect restoration because an inadequate adaptation of the restoration may be detrimental to both the tooth and supporting periodontium. [5-9]

The marginal accuracy of restoration is influenced by shape, size, type and location of finish line as well as the restorative material and the procedure used.[10-20]

Poor internal adaptation could result in reduced resistance to fracture. Although no conclusive evidence is available concerning the optimal internal adaptation, 50 to 100 μm is considered acceptable in due respect of the physical and clinical properties of resin-based luting agents.[21-26]

It was proposed that a restoration would be successful if marginal gaps and cement thicknesses of less than 120 μm could be achieved [27,28]. It was reported that the marginal adaptation of Targis/Vectris crowns with a shoulder finish line was significantly better than crowns with a chamfer finish line before and after cementation with dual polymerizing resin luting agent (Variolink II ; IvoclarVivadent)[10].

Controversy still exists regarding the optimum margin design and technique of restoration fabrication, when using polymer based materials for extra coronal restoration.

Review

Nowadays patient satisfaction and esthetics live a great moment in the history of dentistry. The demand for esthetic nonmetallic biocompatible dental restorative material with high strength, natural color, good wear resistance, marginal integrity and ease of fabrication has increased markedly.[29,30]

The compromised esthetics due to the use of ceramo-metallic restoration has led to the search for new restorative materials that have good physical and esthetic properties.[31]

All ceramic restorative material provides superior esthetic and natural color match more than any other material. However, they are not as strong as ceramo-metallic and they wear down opposing teeth a little more than metal or resin crowns. On the other hand all resin dental crowns are more economic than other crown types, but, they wear down over time and are more prone to fracture than ceramo-metallic or all ceramic crowns.

CEREC machine allows a dental practitioner to produce an indirect dental restoration using a variety of computer assisted technologies, including 3D photography and CAD/CAM. With the use of CEREC system, teeth can be restored in a single sitting with the patient, rather than the multiple sittings required with earlier techniques. Additionally, with the latest software and hardware updates, crowns, veneers, onlays and inlays can be prepared, using different types of material.[32]

Paradigm MZ100 Block for CEREC is a composite mill block with superb milling characteristics. It offers exceptional strength, excellent wear, eye-catching esthetics and economical advantages. Paradigm MZ100 block requires fewer manufacturing steps which saves time and insures a consistent high-quality result. With the Paradigm MZ100 block for CEREC, there's no need to glazing or firing, so there's no need to use a porcelain furnace, and no hydrofluoric acid etch is required.[3]

SR Adoro is characterized by the unique handling properties typically found in light-curing composites. The material is fast and convenient to use. Given the soft consistency and excellent modeling properties, SR Adoro enables swift and smooth application procedures. SR Adoro is easy to polish and provides advantageous esthetic results.[4]

Finish line

Finish line is defined as the termination of the preparation or the undrilled tooth structure, it should be smooth and well defined.[35]

Many types of finish line can be used. Feather edge finish line is an indefinite margin and should be avoided but it is conservative to the tooth structure. Knife edge or chisel edge design is a modification of the feather edge by making an angle between the axial surface and the undrilled tooth surface larger than that of the feather edge, but it is still thin margin which leads to over contouring of the restoration and difficulty in controlling the margin. Chamfer finish line design is indicated

for full metal crowns and metallic part of ceramo-metallic crowns, it offers adequate bulk and ease of preparation (0.3-0.5 mm). Deep chamfer (0.8-1.0 mm) is a modification of chamfer design and can be used with all ceramic crown preparations. Shoulder finish line (1.0 mm) forms 90 º angles with the undrilled tooth surface and indicated for esthetic porcelain crowns but it is less conservative to the tooth structure. The 90º internal line angle increases the stress concentration at this area and leads to failure of the restoration. To overcome this disadvantage, roundation of the internal line angle (Rounded shoulder) is done. Another modification is making 120 º angles instead of 90º (Sloped shoulder) or making a bevel to the shoulder design (beveled shoulder) this decreases the possibility of leaving unsupported enamel but they are less conservative to tooth structure.

Cho, et al. (2002)[36]. Evaluated the effect of variations in tooth preparation design on the marginal accuracy (before and after cementation) and on the fracture strength of the ceromer/fiber reinforced composite crown. Three metal dies with varying total occlusal convergence angles (6 degrees, 10 degrees, 15 degrees) were prepared. A total of 30 (10 for each angle) Targis/Vectris crowns were fabricated. The restorations were evaluated for marginal adaption at 48 points on the entire circumferential margin using a stereomicroscope for margin adaptation. The specimens then were compressively loaded to failure in a universal testing machine. Marginal adaptation and the fracture strength were analyzed. Fracture surfaces of the crowns were examined with a scanning electron microscope to determine the mode of fracture. Their result showed that the smallest marginal gap was recorded in angled crowns with a 6-degree convergence (47 μm mean). The marginal gap of most (95.6%) of the crowns was within a clinically

acceptable level (established as ≤100 μm). The mean marginal gap increased significantly after cementation, with the largest increase in the 6 degree group (76 μm mean). The 6-degree angled crowns had significantly higher fracture strength (1543 N) than the more convergent crowns (1366 N) .Scanning electron microscope observation showed that all crowns exhibited a 2-phase fracture pattern: a crack and chipping of the Targis layer followed by adhesive failure. They concluded that within the limitations of this study, decreasing the axial convergence angle of the ceromer/fiber-reinforced composite crowns diminished their marginal gap and increased their fracture strength.

HILGERT, et al (2003)[30]. Investigated the marginal adaptation of ceramic copings (In-Ceram, Vita) using two different finish lines and an internal surface treatment, (Rocatec, ESPE). Two master steel dies were milled with all-ceramic crown preparations, one with a round shoulder (RS) margin design, and the other with a deep chamfer (DC). Twenty copings were fabricated, and the marginal discrepancy was evaluated in a measuring microscope, obtaining an initial measurement. Each group was subdivided in two subgroup, which either received silica sandblasting in all the inner crown surfaces or silica sandblasting of all the inner crown surface but with preserving the cervical area. They concluded that no significant differences were found among the finish line for the pre and post-sandblasting group. On the other hand there was negative influence of sandblasting with the deep chamfer finish line, wither relieved or not in the cervical area.

Cho, et al. (2004)[10]. Studied the effect of finish line variations on the marginal accuracy and fracture strength of ceramic optimized polymer/fiber-reinforced composite crowns. They prepared four metal