Fracture resistance and interfacial adaptation of MOD cavities restored with contemporary resin composite : incremental versus bulk technique

مقاومة الكسر و التكيف البيني للحفر السنية (ثلاثية الاسطح) االممرممة بواسطة الكمبوزيت الراتنجي :تقنية االحشو الجزئي في مقابل الحشو الكلي

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By

Shimaa fathy metwally mohmed

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Faculty of oral and dental medicine

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بسم الله الرحمن الرحيم

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا
إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ

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Supervisors

Dr. Mohamed Mahmoud Abd El-Mohsen

Professor of Operative Dentistry

Faculty of Oral and Dental Medicine

Cairo University

Dr. Ahmed El-Zohairy

Assistance Professor of Operative Dentistry

Faculty of Oral and Dental Medicine

Cairo University

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بكاليورس طب جراحة الفم والأسنان –جامعة القاهرة

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المشرفون

ا.د / محمد محمود عبد المحسن

استاذ العلاج التحفظي

كلية طب و جراحة الفم و الاسنان

جامعة القاهرة

ا.د / أحـــمـــد الـــزهـــيري

استاذ مساعد العلاج التحفظي

كلية طب الفم و الاسنان

جامعة القاهرة

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Shimaa Fathy Metwally Mohamed

Dedication

To my precious family for their unconditional love

&

Their enthusiastic support in every step of my life

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Introduction

Since the first successful resin-based composite (RBC) material was reported by Bowen in the early 1960s, [1] manufacturers have attempted to improve the physical and mechanical properties of RBC materials [2, 3].

The free radical polymerization of methacrylate RBC materials is associated with a post-gel contraction [4] which is constrained by the adhesive bond at the tooth/RBC interface and manifest as shrinkage stress. [5].The synergism at the tooth/RBC interface may be compromised by the shrinkage stress generated on light irradiation[4] thereby increasing the potential for mechanical failure by allowing the ingress of bacteria,[5] ultimately leading to secondary caries,[5–7] pulpal inflammation,[6] necrosis[7] or postoperative sensitivity.[3] RBC manufacturers have made significant developments to reduce the shrinkage stress generated on light irradiation and today dentistry boasts RBC filler technology that encompass nanotechnology[8] and non-methacrylate based monomeric resin formulations.[9]

The filler loading of modern day RBCs often exceed 60% filler volume fraction [10] by employing nanoparticles in conjunction with larger filler particles which results in reduced shrinkage stress generated following light irradiation. [11]

Prior to the development of non-methacrylate based monomeric resin formulations in 2000,[9] manufacturers tended to concentrate on reducing the shrinkage stress by limiting or eliminating the diluent (triethyleneglycol dimethacrylate (TEGDMA)) from the monomeric resin formulations.[12]

In addition, the selective techniques of resin composite application were becoming the important choice for direct restoration, bulk and

incremental. The incremental (horizontal, vertical, oblique) were capable of reducing shrinkage stress and thus reduction of microleakage between the restoration and the tooth structure. In case of the incremental technique, time consuming was consider the main problem in its application. But in case of bulk; the time factor was solved. Unfortunately, the bulk technique suffers from the insufficient light of penetration.

Currently the term "bulk fill" of the used restorative material in this study mean the entire cavity is filled in one single increment. Recently, some manufacturers introduced material that claimed to be cured up to 4mm.

This study was carried out to evaluate fracture resistance of the teeth and the interface of bulk filling composite material, in comparison the traditional incremental filling technique.

Review of Literature

Review of Literature

Carlos-Campodonico et al., (2011) **(13)** tested cuspal deflection and depth of cure resulting from the use of different techniques (bulk, incremental, bulk/transtooth illumination) and two resin-based composites (deep curing and conventional).used restored extracted teeth with deep-curing X-tra fil (VOCO, Cuxhaven, Germany) (by using bulk and incremental techniques) and Filtek Supreme Plus (3M ESPE, St. Paul, Minn) (by using bulk, incremental and bulk/transtooth-illumination techniques). The sample size for each technique was five. They determined cuspal deflections as changes in buccal and lingual surfaces before and after restoration. To determine the extent of cure, they measured hardness 0.5 to 3.5 millimeters deep on the sectioned restorations. They found no difference in cuspal deflection between filling techniques within the same materials ($P > .05$).

They found no difference in hardness for X-tra fil at any depth with either the bulk or the incremental technique ($P > .05$). Filtek Supreme Plus had higher hardness values at depths of less than 1.5 mm with the bulk/transtooth-illumination technique, whereas the bulk technique resulted in lower hardness values at depths of 2.0 mm and below ($P < .05$). Conclusion was that Cuspal deflection was not affected by filling techniques. X-tra fil cured up to a depth of at least 3.5 mm; Filtek Supreme Plus had lower curing values below a depth of 2 mm. The transtooth-illumination technique improved curing depth for restorations placed in bulk. Clinical Implications; using resin-based composite restorative materials, clinicians should be more concerned about the