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Clinical assessment of a nanohybrid and silorane low shrinkage composite in class I cavity preparation (preliminary report)

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Abstract

Objectives: The purpose of this study was to evaluate and compare the clinical performances of two different posterior composites in Class I restorations.
Methods: In twenty patients a total of 40 Class I cavities were restored with a nanohybrid composite (Tetric EvoCeram) and a low shrinkage composite (Filtek™P90), using their self-etch adhesives. The restorations were clinically evaluated 1 week after placement as baseline, 6, 12 and 18 months post-operatively using modified USPHS criteria by two previously calibrated operators. Statistical analysis were performed using Pearson Qui square and Fisher's Exact Test ($P < .05$). Replicas were taken to the restored teeth under investigations at each recall period and gold sputtered, to be examined under the SEM.
Results: Lack of retention was not observed in any of the restorations. With respect to marginal discoloration, marginal adaptation, secondary caries and surface texture, no significant differences were found between two restorative materials tested after 18 months ($P > .05$). Regarding the surface roughness, no statistical significant difference was recorded, however it was recorded that the results obtained by the tested silorane-based composite were slightly higher. This observation was repeated in describing the % of marginal discoloration of both group I and II at different follow up periods .The difference between both groups was not significance. Restorations did not exhibit post-operative sensitivity at any evaluation period. Concerning the data collected from SEM images no significant difference was recorded comparing both groups at any of the evaluation periods.
Conclusions: Clinical assessment of Tetric EvoCeram and Silorane composites exhibited acceptable results.

Keywords: Clinical evaluation; Nanohybrid composites; Low shrinkage composites

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1. Introduction

Patient demand for tooth colored restorations and desire for minimally invasive restorations have made posterior composites an indispensable part of the restorative process instead of amalgam [1].

Many clinician have used this class of materials quite successfully during the last 10 years in posterior

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stress bearing areas [2] .Many commmercially available dental composites are based on methacrylate chemistry, and volumetric shrinkage still remains a major drawback, this can result in gap formation at the tooth restoration interface causing microleakage, permitting the passage of bacteria and oral fluids resulting in post-operative sensitivity, pulpal inflammation, and secondary caries [3]. Polymerization shrinkage may also generate stresses that can lead to cusp deflection, lack of appropriate contact and debonding at the composite/tooth interface leading to postoperative pain [4].

Investigators across the globe are researching new materials and techniques that will improve polymerization shrinkage and thus the clinical performance. In addition to handling characteristics, mechanical and physical properties of composite resin restorative materials and placing thicker adhesive layers under the composite [5] and using an incremental placement technique [6] or the use of low-modulus intermediate layers are just some manipulations suggested to reduced shrinkage stress for a given composite material at the composite/tooth interface [7]. Other factors also can be considered, for example, the cavity configuration factor (C-factor) which describes the ratio of bonded surfaces to unbonded surfaces in a restoration. With the use of bonded shrinking polymeric materials, high C-factors are accompanied by greater internal stresses [8,9].

Silorane, a new class of ring-opening monomers were synthesized to overcome these problems. This new type of monomer is obtained from the reaction of oxirane and siloxane molecules with a volumetric shrinkage determined to be 0.99 volume percent [10,11].

The novel resin also considered to have combined the two key advantages of the individual components: low polymerization shrinkage due to oxirane monomer and increased hydrophobicity due to the presence siloxane species in its composition promoting the insolubility of the material in the presence of oral fluids [12].The mechanism of compensating stress in this new system is achieved by opening and extending of oxirane rings during polymerization to compensate volume reduction by monomer packing [13].

Some laboratory findings which should be substantiated by clinical investigations recommended that silorane-based composite reduce shrinkage stress Since they have been shown to shrink less thus incremental layering, may be no longer needed .However regarding

Table 1
Material used in the present study.

Material	Composition	Manufacturer	Batch no.
Filtek silorane P90. (silorane based composite)	BIS-3,4-Epoxy cyclohexylethyl-phenyl-methylsilane 3,4-Epoxy cyclo hexyl cyclopo lymethyl siloxane silanized ,Quartz , yttriumfloride (0.1−2 μm,55 vol%1).	3M ESPE, Seefeld-Germany www.3MESPE.com	N138860
LS (low shrinkage) Adhesive	Self-etch primer: Phosphorylated methacrylates, vitrebond copolymer, bisphenol A diglycidylmethacrylate (BisGMA), hydroxyethyl methacrylate. (HEMA), water, ethanol, silane-treated, silica, filler, initiators, stabilizers. LS Bond: Hydrophobic methacrylates, phosphorylated methacrylates, triethylene glycol dimethacrylates (TEGMA), silane-treated silica filler, initiators, stabilizers	3M ESPE, Seefeld-Germany www.3MESPE.com	20090609
Tetric EvoCeram (methacrylate baesd composite)	Dimethacrylate, additives, catalyststabilizers, pigments inorganic filler (Barium glass filler, ytterbium trifluoride, mixed oxide, prepolymers).	IvoclarVivadent, Schaan, Liechtenstein www.ivoclarvivadent.com	L39741
AdheSE adhesive	Primer: Phosphonic acid acrylate Bis-acrylamide .Water Initiators and stabilizers. Bond: Dimethacrylates Hydroxyethyl methacrylate, Highly dispersed silicon dioxide, Initiators and stabilizers, Activator Solvent Initiators.	IvoclarVivadent, Schaan, Liechtenstein www.ivoclarvivadent.com	G 05739
Epoxy resin Epon. (Resin and hardener)	Resin: bisphenol a and epichlorohydrin. Hardener: Cycloaliphatic curing agents an ammonia with one or more hydrogen atoms.	Chemical Industries for construction, CIC, Egypt www.cic-polymar.com	EVERFIX (#100642, 100643)