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Flowable composites for restoration of non-carious cervical lesions: Results after five years

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ABSTRACT

Objectives. To evaluate the clinical performance of two flowable composites for restoration of Class-V non-carious cervical lesions (NCCLs), one with novel (N'Durance® Dimer Flow, Septodont; ND) and one with modified conventional matrix composition (Filtek™ Supreme XTE Flow, 3M-ESPE; FS). The null hypothesis was that both flowable composite materials perform equally regarding clinical quality and survival.

Methods. 50 patients received one ND and one FS restoration of NCCLs in premolars using Clearfil Protect Bond (Kuraray) as an adhesive without additional selective enamel etching. Restorations were evaluated at baseline (BL), after 30 and 60 months employing selected original FDI criteria and refined FDI criteria by separate evaluation of enamel and dentine margins. Non-parametric statistical analyses and χ^2 tests were applied ($\alpha = 0.05$).

Results. 38 patients with both restorations under risk were available for the 60-mo recall (recall rate: 76%). At 60-mo, 94.7% of ND and 84.2% of FS restorations were rated clinically acceptable. No significant differences for all selected FDI criteria were recorded between ND and FS at each examination time point except for the criteria surface lustre at 60-mo, where FS showed significantly better results. No significant differences over time could be detected for both materials. There was a trend for more deterioration along the enamel margins than along the dentine margins (criteria *marginal staining* and *marginal adaptation*).

Significance. Within the limitations of the study, the null hypothesis that materials perform equally could not be rejected. Both flowable composites performed similarly regarding clinical performance.

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1. Introduction

Non-carious cervical lesions (NCCLs), which are defined as a loss of dental hard tissue at the cemento-enamel junction, are commonly encountered clinical conditions in dental practice [1]. Prevalence rates have been estimated to be between 2 and 90% and are likely to raise in an ageing population where teeth are increasingly retained for a lifetime [2]. In cases when tooth hypersensitivity occurs, pulp vitality is affected or when plaque retention is promoted, direct restorative treatment of NCCLs may become necessary [3]. In these situations, methacrylate-based composites are considered the gold-standard for direct restorative procedures due to their better esthetic as well as mechanical properties as compared to glasionomer cements or hybridionomers [4].

For restoration of NCCLs, especially the use of flowable composites seems to be rational, as their modulus of elasticity is substantially lower as compared to packable composites, which has been proposed to result in an increased absorption of polymerization shrinkage and flexural stress [4,5]. However, this assumption has not been substantiated yet in clinical studies in terms of a higher retention rate for flowable compared to packable composites [6]. It is also known that the reduced viscosity of flowable composites (achieved by either reduction of filler content or increase of diluent monomers like triethylene glycol dimethacrylate (TEGDMA) in the composite matrix) leads to a higher polymerization shrinkage which on the other hand results in more stress at the adhesive interface and may raise concern about sufficient marginal sealing, especially in non-retentive cavities like NCCLs and after longer periods of clinical service [7–9].

As a compensation for that, some contemporary flowable composite materials exhibit a slightly modified matrix composition, *e.g.* Filtek™ Supreme XTE Flow (FS; 3M-ESPE, Seefeld, Germany), where TEGDMA is partly substituted by the high-weight and low-viscosity monomer Procrylat (2,2- bis-4-(3-hydroxy-propoxy-phenyl)propane dimethacrylate; Fig. 1A). Furthermore, recently flowable composite materials with novel matrix technology have been introduced onto the market, where conventional monomers like TEGDMA, urethane dimethacrylate (UDMA) or bisphenol A glycidyl methacrylate (bis-GMA) are at least partially replaced by dimer-acid dimethacrylate monomers [10]. The latter show less volumetric shrinkage due to polymerization-induced phase-separation and exhibit a higher degree of monomer conversion and virtually negligible water sorption as compared to conventional monomers [11]. A commercially available representative of this group is N'Durance® Dimer Flow (ND; Septodont, Saint-Maur-des-Fossés, France), which comprises dimer dicarbamate dimethacrylate (DDCDMA; Fig. 1B) with ethoxylate of bisphenol A dimethacrylate (EBPADMA) as base resin and UDMA as a minor compoment.

Recently, we have reported the three-year-results of a randomized clinical trial investigating the clinical performance of two flowable composite materials, one with modified conventional (FS; serving as control group) and one with novel matrix composition (ND; serving as test group) for restoration of NCCLs (see Table 1 for selected mechanical properties of both materials) [12]. After three years of clinical service, we found that both materials exhibited identical clinical success rates of 95.8% with no statistically significant differences in all FDI clinical rating criteria except *surface staining* and *marginal staining* (both in favour of FS) [12].

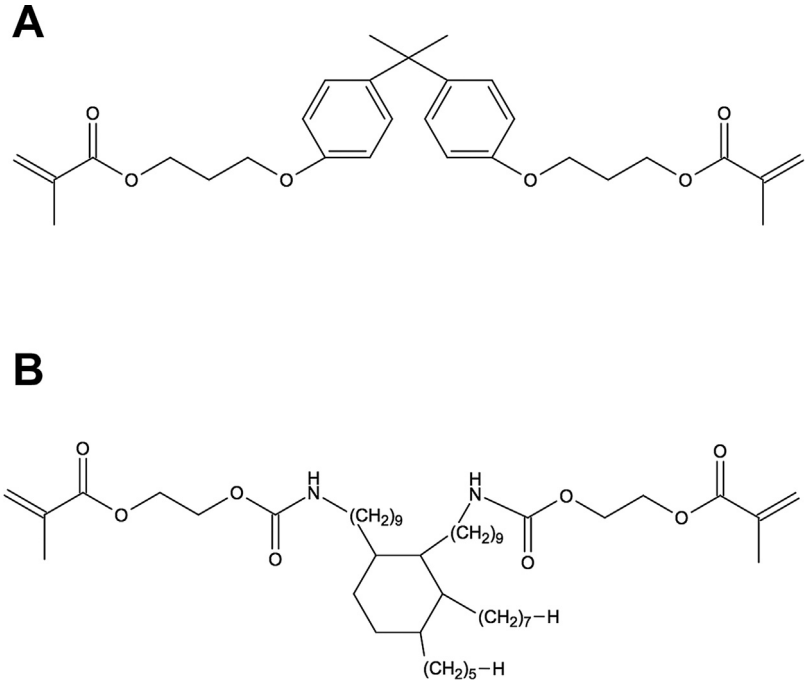

Fig. 1 – Structural chemical formulas of new monomers comprised in FS and ND according to the specifications of the respective manufacturer.
A: Structural chemical formula of Procrylat, comprised in FS. B: Structural chemical formula of DDCDMA, comprised in ND.

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