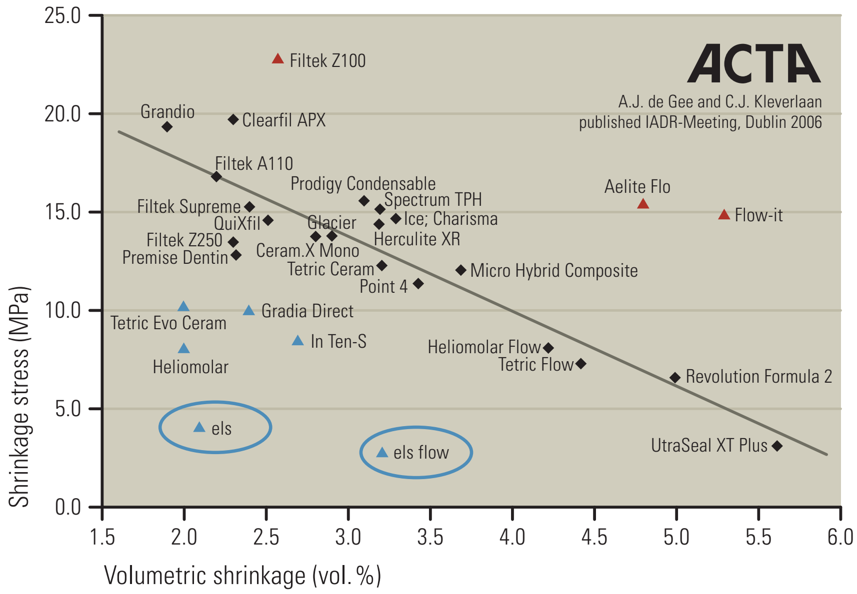
SAREMCO
DENTAL

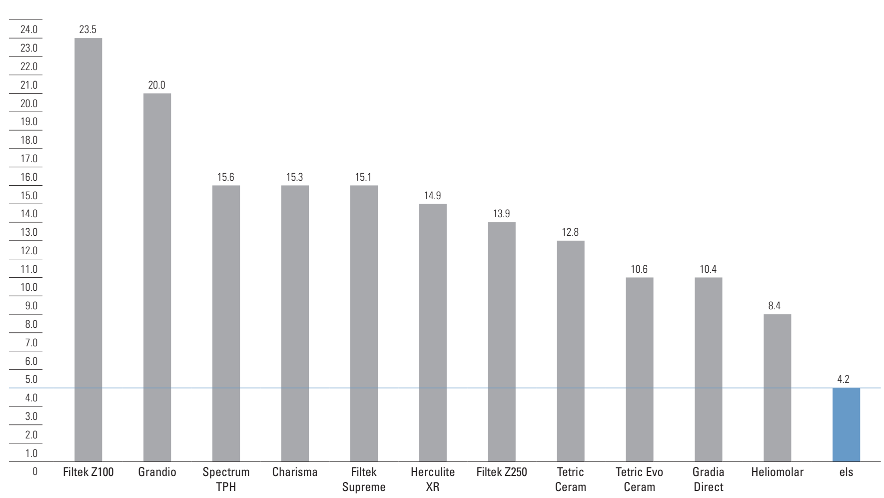
# Extract of a selection of recent studies

## ACTA | Shrinkage stress versus volume shrinkage

**Regression plot: shrinkage stress / volumetric shrinkage**
(30 min values)




## ACTA | Shrinkage stress of several dental composites (MPa)




This graphical presentation results of the original data from the study of ACTA published at IADR Meeting Dublin 2006 (see above).

# Qualitative and quantitative analysis of eluted compounds from dental composites

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## Introduction

Comonomers and monomers are used as dental restorative materials (e.g. in dental composites). Unconverted compounds can be released from dental composites and can enter the body in humans. Dental composite components can be metabolized to (toxic) intermediates in the organism. This study was evaluated to qualify and to quantify eluted compounds from various dental composites. The methods of gas chromatography/mass spectrometry (GC-MS) and liquid chromatography/mass spectrometry (LC-MS) were used.

## Results

From all composites 18 different chemical compounds were found. Following comonomers were quantified (µg/ml; mean ± s.d.; n = 3) (see table below):

### Methanol-Eluates

**HEMA** | The highest HEMA concentration was found in the eluate from the composite „Gradia" (G.C.) 500 ± 66 µg/ml.

**TEGDMA** | The high est TEGDMA concentration was found in the eluate from the composite „Synergy Duo Shade" (Coltène) 126 ± 23 µg/ml.

### Water-Eluates

**HEMA** | HEMA was not detectable (below limit of detection) in the eluate of any composite.

**TEGDMA** | The highest TEGDMA concentration was found in the eluate of the composite „Venus" (Kulzer) 126 ± 23 µg/ml.

### Additives and other compounds in the eluates (water, methanol)

Following additives were found in the range of 3 – 334 µg/ml from various composites: DMABEE, TINP, HQME, BPE, BHT, HMBP, DCHP, TPSb, DMABEHE, DMABBEE a.o. Isobornylmethacrylate, BisGMA, and UDMA were not found in the eluates (water, methanol) from all composites

## Discussion

Different quantities of organic compounds, eluted from various composites were found.

The toxicity of the eluted comonomers HEMA and TEGDMA is described in detail (Reichl et al. 2006, Arch. Toxicol., 80(6):370-377). The toxicity of the eluted and detected additives (e.g. cointitiators, inhibitors) is also described, but in general they have a low toxicity and for the risc assessment of dental restorative materials they are of minor relevance.

**From all tested composites HEMA and TEGDMA were below limit of detection as well as in the water- and in the methanol-eluates from Els extra low shrinkage.**

## Conclusion

Following range of the eluted and detected comonomers from dental composites was found (dest. water; decreasing elution):

Venus > Gradia > Synergy Duo Shade > Tetric Evo Ceram > Premise > Grandio > **Els extra low shrinkage**

### Qualitative and quantitative analysis of eluted compounds from dental composites

(Reichl FX, Seiss M, Oxynos A, Folwaczny M, Glas J, Kehe K, Hickel R (published IADR 2007)

| | detected comonomers | | | |
|---|---|---|---|---|
| | dest. water | | methanol | |
| **composites** | **HEMA** | **TEGDMA** | **HEMA** | **TEGDMA** |
| **els extra low shrinkage®** | n.d.* | n.d.* | n.d.* | n.d.* |
| Grandio | n.d.* | 36 ± 5 | n.d.* | 68 ± 12 |
| Premise | n.d.* | 48 ± 7 | n.d.* | 51 ± 9 |
| Tetric Evo Ceram | n.d.* | 57 ± 12 | 496 ± 77 | n.d.* |
| Synergy Duo Shade | n.d.* | 104 ± 16 | n.d.* | 126 ± 23 |
| Gradia | n.d.* | 123 ± 18 | 500 ± 66 | 62 ± 2 |
| Venus | n.d.* | 197 ± 26 | n.d.* | 76 ± 7 |

* n.d. = not detectable (below limit of detection).

**Figure 1:**
Used gas chromatography/mass spectrometer (GC-MS; upper figure) and liquid chromatography/mass spectrometer (LC-MS; lower figure).

# Post-operative Sensitivity in Response to Adhesive/Composite System and Operator Skills

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### Objectives

This clinical investigation assessed [1] if there is a reduction in clinical post-operative sensitivity in teeth restored with either one of two low-shrinkage stress composites compared to teeth restored with conventional hybrid composites, and [2] the influence of operator skills on this phenomenon.

### Methods

720 permanent premolar and molar teeth affected by primary carious lesions and in full physiological contact with both the adjacent and antagonist teeth were used. All cavity margins were in sound enamel. Cavities where the gingival wall was in cementum/dentine were excluded from the study. Only teeth with a cavity depth of at least 2 mm into dentine were included in further evaluation. Cavities were restored using the modified incremental technique (Lutz et al. 1986). The following 6 groups contained 120 restorations, each: (1) **els®+James-2**, (2) els® + Excite, (3) InTenSe + James-2, (4) InTenSe + Excite, (5) Tetric Ceram + Excite, and (6) Point 4+OptiBond Solo Plus. Two operators had five year (A & B), two others had over 20 years (C &D) clinical experience. Patients were assessed for post-operative sensitivity at 7 and 28 days. Assessments were conducted by an operator other than those who had placed the restoration, using a pre-prepared questionnaire. Data were statistically analysed using non-parametric chi-square and ANOVA tests.

### Results

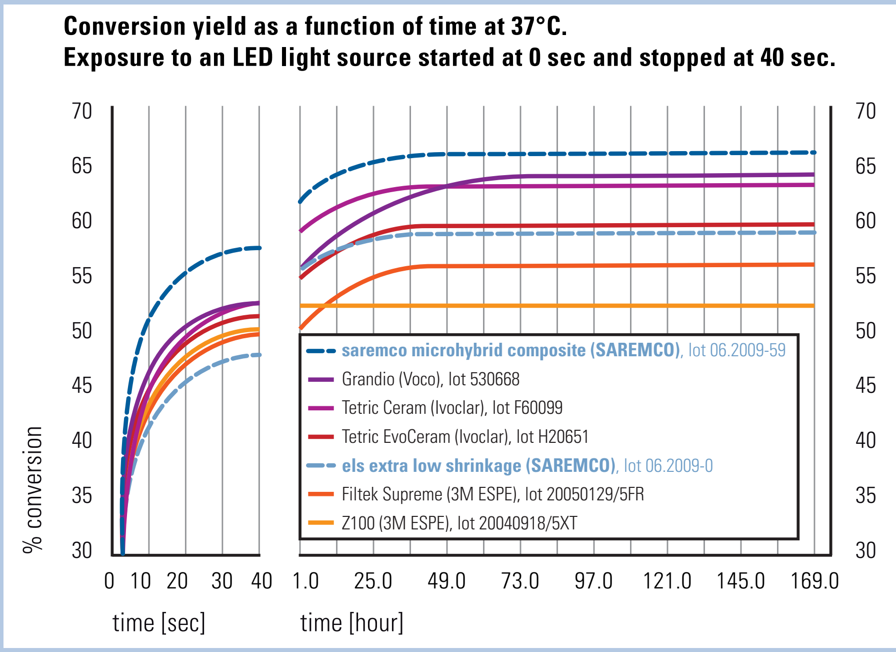
**Least post-operative sensitivity was reported (6.67 %) where adhesive James-2 with two low-shrinkage composites were applied.** Group 6 gave the highest score (40 %) with significant difference from other groups ($p < 0.05$). There was no statistical difference among groups 1, 2, 3, 4, and 5. Operator A had the highest postoperative sensitivity score (16.25 %) and was statistically different to the other three ($p < 0.01$).

### Conclusions

Operator skills were the chief reason influencing postoperative sensitivity of composite restorations, though low polymerization shrinkage stress, and also type of adhesive had an effect.

# EPFL: conversion rate of composites

Tuan Q. Nguyen, Lab. des Polymères, EPFL, IMX-LP, March 2006



# Technical Data

| els extra low shrinkage | |
|---|---|
| Resin | 263 mg BisGMa / BisEMa |
| Mineral filler content | 737 mg/g BaAlBSi, silanized, ø 0,7 µm, max. 2,6 µm |
| Operation light resistance | > 5 min at 11´000 lux |
| Depth of cure | 2.8 mm in 20 s/ 2.9 mm in 40 s [2] |
| Flexural strength | 9.0 GPa |
| Water sorption | 0.21 % (24 h) / 0.60 % (7 d) [3] |
| Dissolution | 0.03 % (24 h) / 0.09 % (7 d) [3] |
| Shades | matching VITA Shade Guide |
| Colour Stability | stable according to ISO |
| Radio-opacity | 217 % Aluminium |
| Vickers Hardness | 68 (at 0.3 mm, 7 d) [1] |
| Barcol Hardness | 81 |
| Polymerization shrinkage stress | 4.2 MPa after 30 min [4] |
| Volumetric shrinkage | 1.3 vol % (60 s) / 2.5 vol % (240 min) [4] |
| Wear | 63 µm (60 d) (ACTA, ISO 14569-2) [5] |
| Consistency | highly viscous, homogeneous paste |
| Appearence after curing | homogeneous, smooth and shiny surfaces, compact structure |
| Conformity with ISO 4049, DIN, ADA, BSI | fulfilled |

1) Prof. Jean-Marc MEYER, University of Geneva, 2002, unpublished
2) C.J. KLEVERLAAN, A.J. DE GEE, ACTA, 2002, unpublished
3) Dr. Maria CATTANI, Universitiy of Geneva, 2005, unpublished
4) Prof. A.J. FEILZER, A.J. DE GEE, ACTA, 2005, published
5) A. WERNER, A.J. DE GEE, ACTA, 2003, unpublished

| cmf etch gel | |
|---|---|
| Acid content | 35% Phosphoric acid |
| Buffer | buffered with Phosphatesalt |
| Colour | Blue |
| Consistency | Medium viscous, homogeneous liquid |
| pH Value | 1.5 |

| cmf prime | |
|---|---|
| Product description | co monomer free primer |
| Composition | acetone, ethanol, phosphonic acid, methacrylate |
| Appearance | Clear yellowish liquid |
| Consistency | liquid |

| cmf bond | |
|---|---|
| Product description | solvent free, co monomer free bonding adhesive |
| Composition glass | ethoxylated BisGMA, silanized Ba-glass |
| Appearance | white to yellow |
| Consistency | viscous liquid |
| Shear bond strength | > 12 MPa |
| Micro-tensile bond strength to dentine | 25 MPa [1] |
| Micro-tensile bond strength to enamel | 31 MPa [1] |
| Marginal seal to enamel | 100% [2] |
| Marginal seal to dentine | 99% [2] |

1) De Munck J., Van Meerbeek B. *et* al., Leuven BIOMAT Research Cluster 2007, priminary results, unpublished
2) Blunck U. Charité Berlin, 2006, unpublished in-vitro assessment

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