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Effect of mesoporous fillers and resin composition on the biological behavior of dental composites

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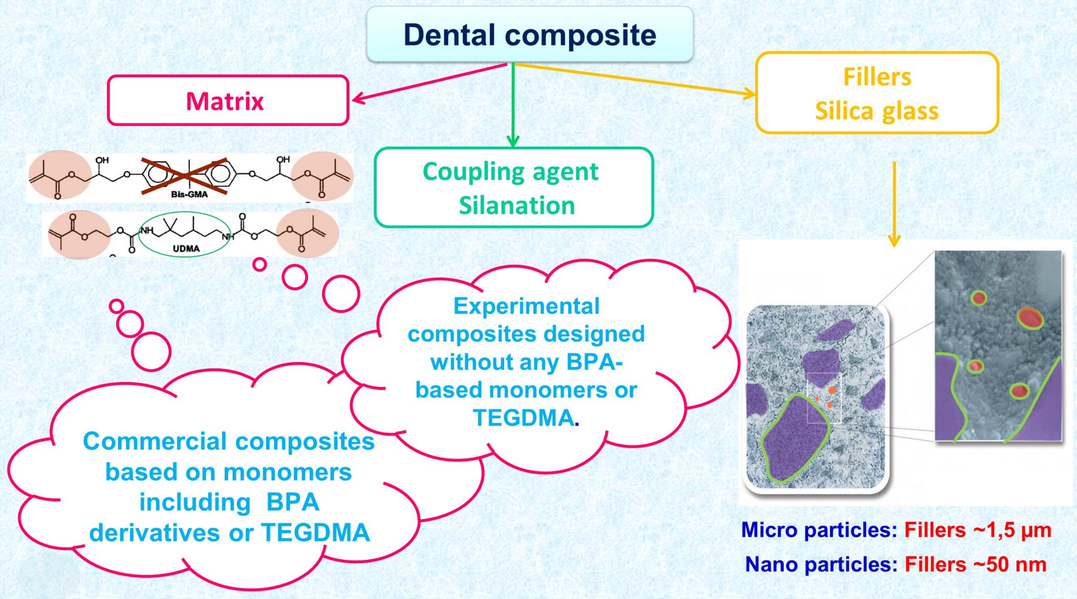
Objectives

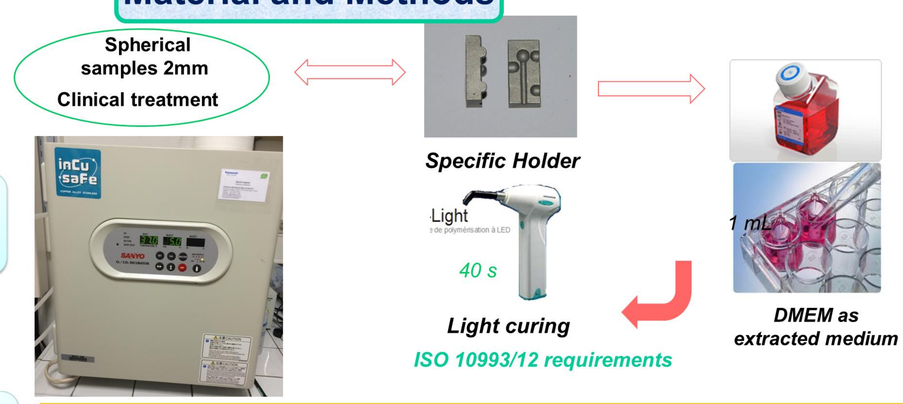
New dental composites containing mesoporous silica fillers have been developed to improve rheological properties and enhance the resin-filler interface.



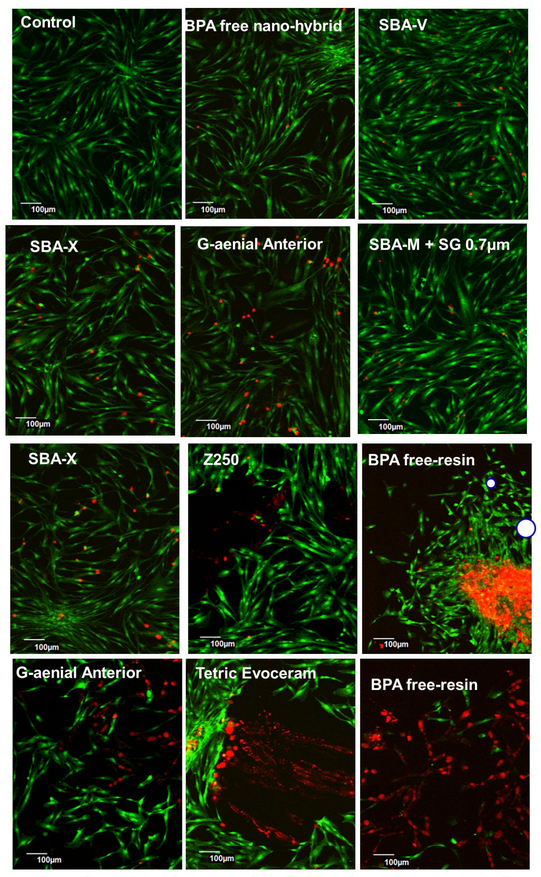
Micro particles: Fillers ~1,5 µm
Nano particles: Fillers ~50 nm

We aimed to compare the cytocompatibility of commercial and experimental dental composites for a better understanding of factors affecting cytocombatibility. Two aspects have been considered:
- **Presence of BisGMA or TEGDMA among the resin monomers.**
- **Presence of porous particles among the filler blends.**

Material and Methods



Results

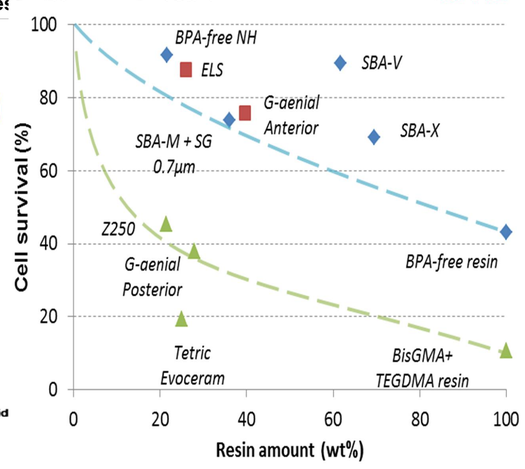


Confocal images of HGFs after 5 hours of exposure to different composites

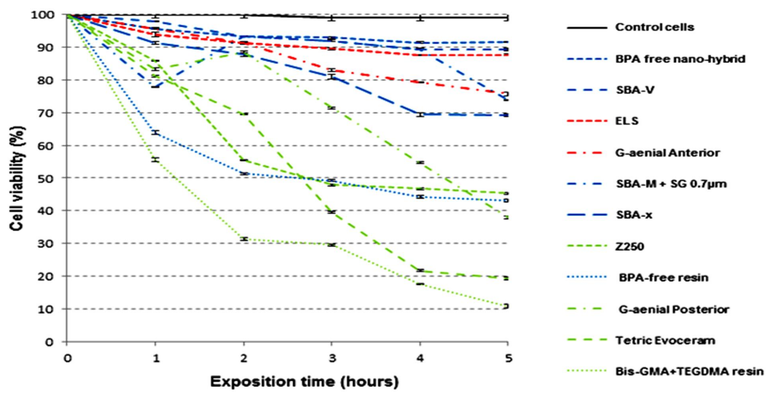
Conversion rate of light-cured composite samples

Sample name	Manufacturer	CR (%)
BPA-free resin	Home resin, LMI, France	78.4 (0.6)
SBA-M + SG 0.7µm	Experimental composite, LMI, France	71.8 (8)
BPA free nano-hybrid	Experimental composite, LMI, France	69.8 (3)
SBA-x	Experimental composite, LMI, France	69.4 (1.9)
Tetric Evoceram	IVOCLAR Vivadent AG, Liechtenstein	64.8 (1.7)
ELS	SAREMCO Dental AG, Switzerland	63.7 (1)
Z250	3M FSPE, USA	61.4 (3.9)
SBA-V	Experimental composite, LMI, France	60.6 (2.5)
G-aenial Posterior	GC Europe	58.7 (2)
G-aenial Anterior	GC Europe	57.4 (3)
-GMA+TEGDMA res		

Green areas are live cells and red areas are damaged cells



Cells viability by resin weight ratio in tested sample extracts



Viability of HGF cells after exposure to sample extracts for 5 hours and conversion rate after light curing

Discussion

- **CR of tested composites ranged from 57% to 72%, which agrees with rates reported in the literature.bComposites with lower CR were not more toxic than those with higher CR, which may be explained by a very low amount of free monomers with CRs > 50%.**
- **The investigated confocal method refers to the cytotoxic potential via membrane integrity and not endocrine disruption potential, BPA-free resin was better tolerated by HGFs than conventional resin-containing BPA derivatives. A positive association between reduced resin ratio and decreased cytotoxicity was shown.**
- **Porous fillers have a huge specific surface, therefore the increased interaction with the matrix as compared with conventional dense fillers has an effect on cytotoxicity. Experimental composites containing only mesoporous fillers showed higher cytocompatibility. This finding may be explained by a lower interaction of the resin trapped Inside the pores with the test medium during the elution step.**

Conclusions

- **Cytocompatibility was directly related to the amount of resin in composites; No effect of CR on cytocompatibility was shown.**
- **TEGDMA affected cytocompatibility more than Bis-GMA. TEGDMA led to acute toxicity and therefore should be avoided in new formulations.**
- **Mesoporous fillers may be as safe as conventional non-porous fillers in dental composites.**
- **The sensitive confocal imaging method could be helpful in assessing the long-term toxicity of such experimental composites after aging.**

Abbreviations

CR: Conversion rate, BisGMA: bisphenol A (BPA)-glycidyl methacrylate ,TEGDMA: triethyleneglycol-dimethacrylate
FTIR : Fourier transform infra-red,DMEM: Dulbecco's modified Eagle medium, LMI: Laboratoire Multimatériaux et Interfaces
HGF: Human gingival fibroblasts

References

- *Attik & Hallay et al. Dent Mater, 2017; 33, 166-174*
- *Salehi et al. Dent Mater 2015; 31,195-203*
- *Ferracane Dent Mater 2011; 27, 29-38*

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