Faculté de Médecine
Section de Médecine Dentaire
Division de Technologie des Matériaux Dentaires
UNIVERSITÉ DE GENÈVE

Water sorption and dissolution of dental resin composites

Dr. Maria CATTANI-LORENTE

The aim of this study was to compare the water absorption and the dissolution of six dental resin composites. For this purpose specimens of the different materials were immersed in distilled water during either 24 hours or 7 days.

Experimental protocol

The materials tested were ELS, Microhybrid and Microhybrid-MF from Saremco, Tetric Ceram and Tetric EvoCeram from Ivoclar-Vivadent and Filtek Supreme from 3M-ESPE.
For each resin composite, eight disk specimens (ϕ ~9 mm and h~2 mm) were prepared. The samples were covered with strips and the two surfaces were illuminated for 40sec each, with the Elipar Freelight 1 curing device (ESPE) in standard mode (~400mW/cm^2).
The water sorption and dissolution were measured following the ASTM D570 norm: the samples were conditioned in a desiccator at 37°C for ~48 h until their weight remained constant (±0.1 mg). They were then immersed in water at 37°C. Half of the samples were weighted after 24h, half after 7 days. The specimens were reconditioned in a disiccator for ~48h or ~2 weeks at 37°C until attaining a constant weight (±0.1 mg).The increase in weight, the water sorption and dissolution were calculated as follow:

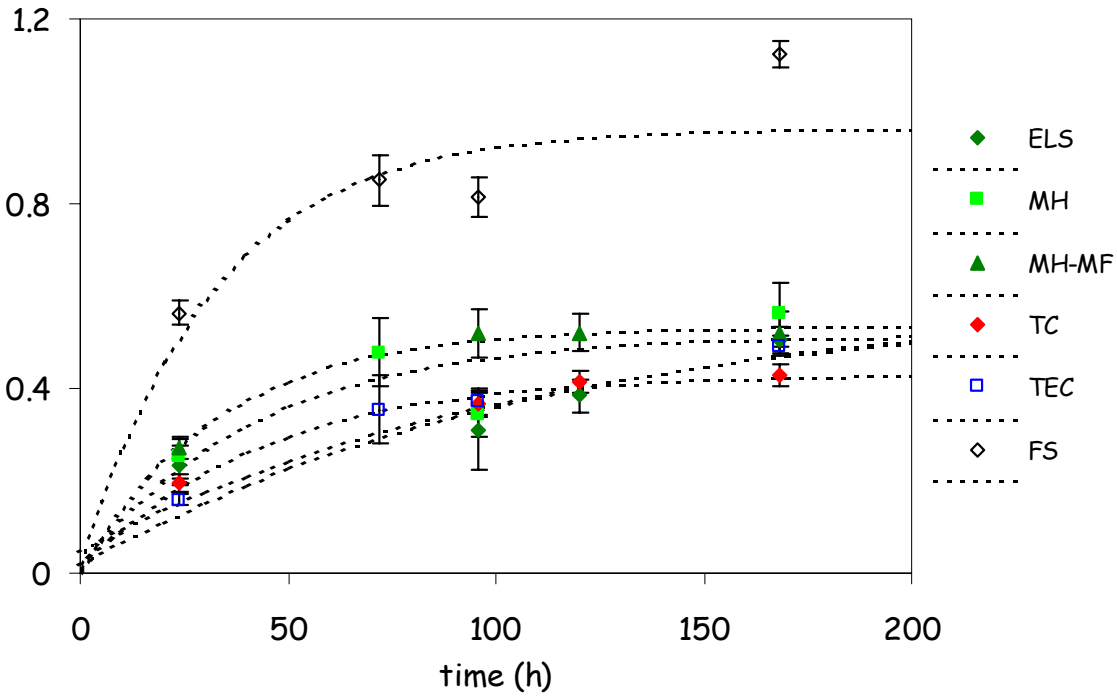
$$\text{Increase in weight (\%)} = \frac{\text{wet wt} - \text{conditioned wt}}{\text{conditioned wt}}$$

$$\text{Dissolution (\%)} = \frac{\text{conditioned wt} - \text{reconditioned wt}}{\text{conditioned wt}}$$

$$\text{Water sorption (\%)} = \text{Increase in weight (\%)} + \text{Dissolution (\%)}$$

Results

The percentage of weight increase is given below as a function of the immersion time interval



Water sorption and dissolution were calculated as a percentage of the initial weight, or in relation with the surface or the volume of the samples. In the tables below, the results are given both in % and in μg/mm^3

	Water Sorption (%)		Dissolution (%)	
	24h	7d	24h	7d
ELS	0.21 ± 0.02	0.60 ± 0.01	0.03 ± 0.01	0.09 ± 0.03
Microhybrid	0.36 ± 0.05	0.64 ± 0.04	0.05 ± 0.03	0.08 ± 0.05
Microhybrid MF	0.33 ± 0.05	0.73 ± 0.03	0.1 ± 0.06	0.2 ± 0.05
Tetric Ceram	0.21 ± 0.03	0.56 ± 0.03	0.05 ± 0.02	0.13 ± 0.03
Tetric EvoCeram	0.31 ± 0.03	0.70 ± 0.10	0.1 ± 0.03	0.20 ± 0.10
Filtek Supreme	0.84 ± 0.05	1.29 ± 0.07	0.25 ± 0.02	0.16 ± 0.07

	Water Sorption (μg/mm^3)		Dissolution (μg/mm^3)	
	24h	7d	24h	7d
ELS	4.1 ± 0.4	11.6 ± 0.3	0.6 ± 0.1	1.8 ± 0.5
Microhybrid	6.9 ± 0.9	12.8 ± 1.0	1.0 ± 0.6	1.6 ± 0.9
Microhybrid MF	6.4 ± 0.9	14.3 ± 0.9	2.1 ± 1.1	4.0 ± 1.0
Tetric Ceram	4.5 ± 0.5	12.3 ± 0.9	1.0 ± 0.4	2.9 ± 0.8
Tetric EvoCeram	6.5 ± 0.6	14.6 ± 2.3	2.0 ± 0.7	4.3 ± 1.3
Filtek Supreme	15.3 ± 0.8	23.9 ± 1.9	4.7 ± 0.3	3.1 ± 1.0

After 24 h, ELS presented the lower water sorption and dissolution, which were comparable to the values obtained for Tetric Ceram. The composites Microhybrid and Microhybrid MF presented similar water sorption than TetricEvoCeram. However, the dissolution of Microhybrid was lower. The highest values were obtained for Filtek Supreme.

After 7days, the composites ELS, Microhybrid and Tetric Ceram presented the lowest water sorption. Compared to ELS and Microhybrid, the dissolution of Tetric Ceram was however a slighty higher. Microhybrid MF and TetricEvoCeram presented similar water sorption and dissolution. Filtek Supreme absorbed the highest quantity of water. The dissolution after 7 days was similar to the dissolution after 24 hours.

An analysis of variance could not be applied to compare the data, because the experimental values did not came from a normal population. In this case, it is recommended to compare the medians (Kruskal-Wallis test) instead of the means. A Box-and-Whisker plot can be used to determine which medians are significantly different from which others at a 95% confidence level.

Resin composites marked with the same letter did not displayed significant differences between the medians.

	Water Sorption ($\mu g/mm^3$)		Dissolution ($\mu g/mm^3$)	
	24h	7d	24h	7d
ELS	a	a	a	a
Microhybrid	b	b	a,b,c	a,b
Microhybrid MF	b	c	c.d	c
Tetric Ceram	a	a,b	b	b,c
Tetric EvoCeram	b	b,c	d	c
Filtek Supreme	c	d	e	a,b,c

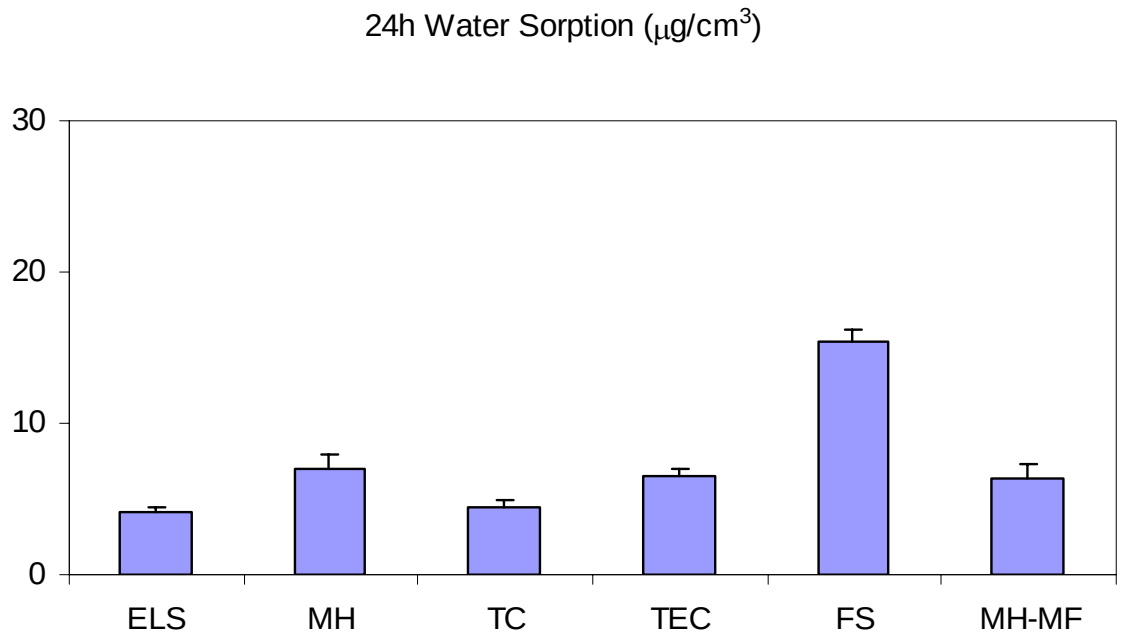
Conclusion

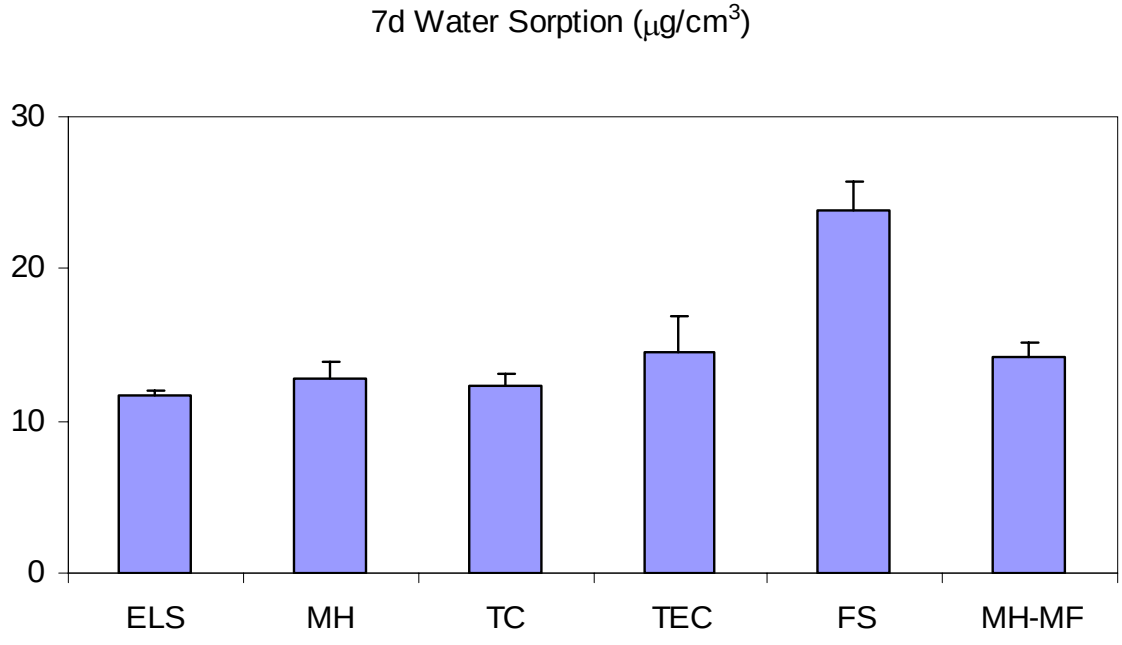
From this study, it can be concluded that ELS presented a low water sorption and dissolution either after 24h or 7 days immersion in water. The sorption and solubility values are comparable to those of others resin composites such as Tetric Ceram.

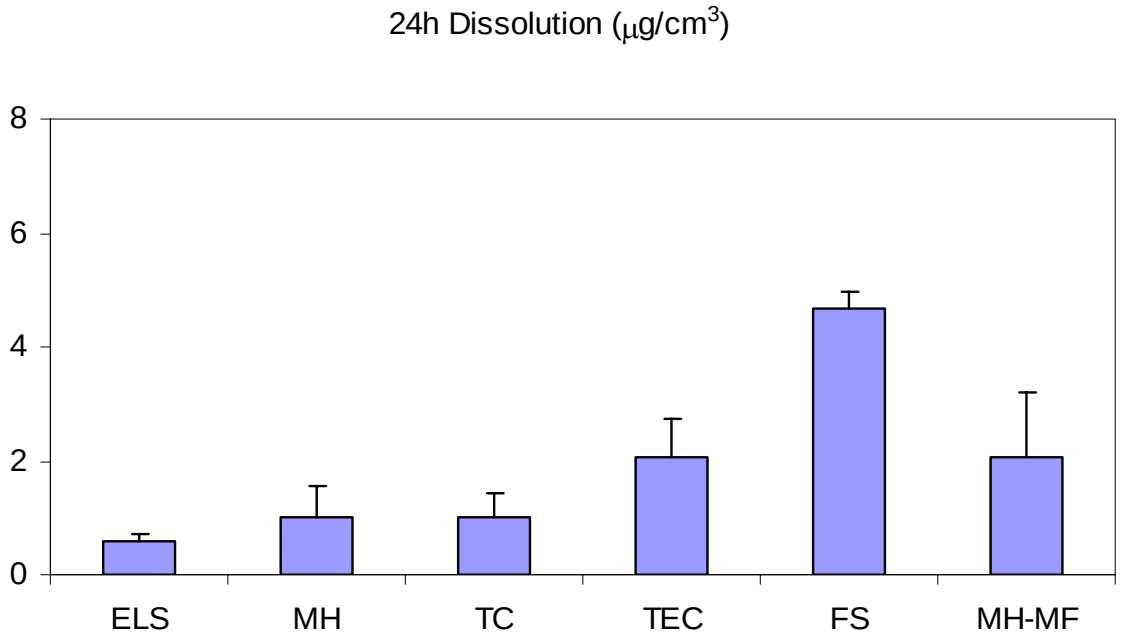
The Microhybrid and Microhybrid MF composites showed a slightly higher water sorption and dissolution comparable to Tetric EvoCeram.

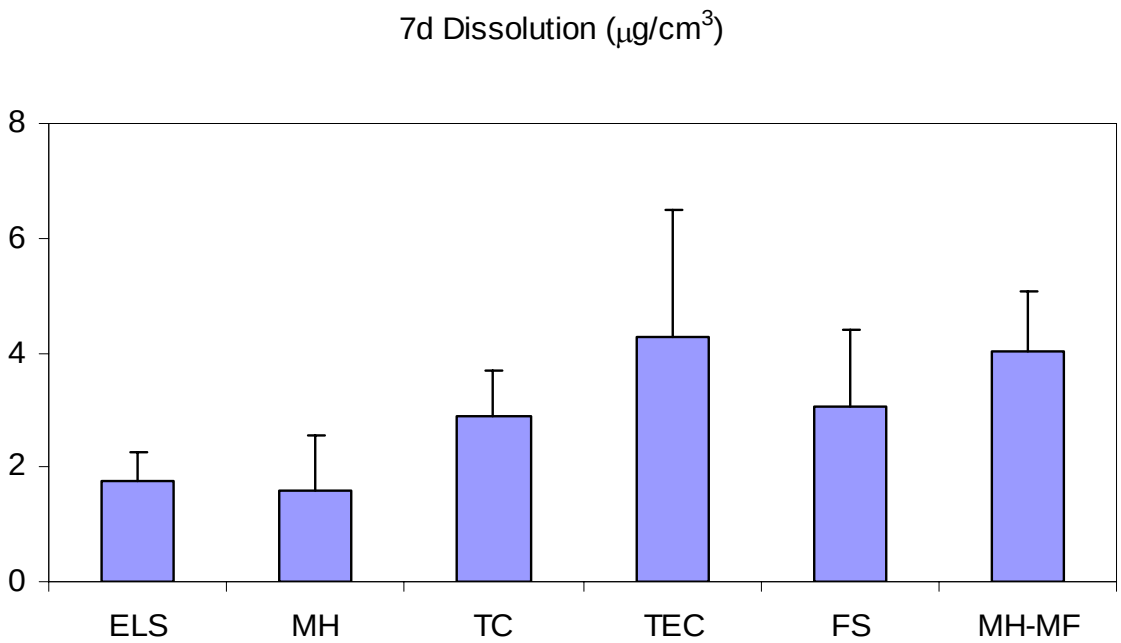
Annexe

Graphic representations of the results.

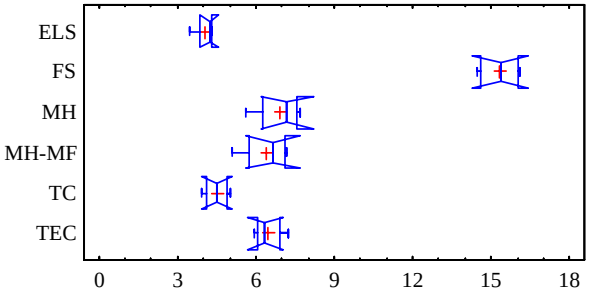




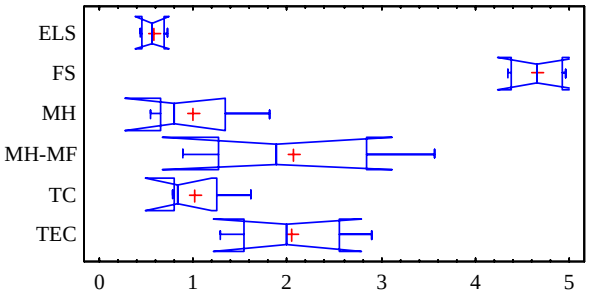

24h Dissolution (μg/cm3)
8
6
4
2
0
ELS
MH
TC
TEC
FS
MH-MF


7d Dissolution (μg/cm3)
8
6
4
2
0
ELS
MH
TC
TEC
FS
MH-MF

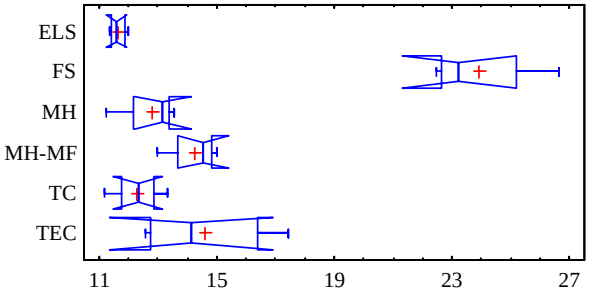
Box-and-Whisker plots



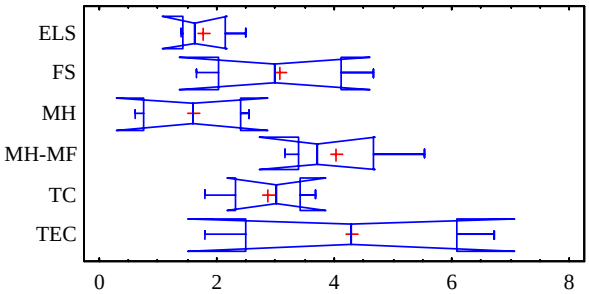
24h water sorption



24h Dissolution



7d Water sorption



7d Dissolution