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Effect of Material and Storage Temperature on Sealant Microleakage

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Objectives: To investigate how material type and storage temperature affect the marginal microleakage of different sealant materials. This study is part of a larger analysis that aims to establish recommendations for management of materials in settings where cooling systems may not be accessible (i.e., extreme climate conditions in resource-limited countries).

Methods: Ninety extracted human teeth were obtained. Samples were randomly assigned into 9 groups (n=10). Three sealants were tested: GC Fugi® Triage GC America (GC), Embrace™ WetBond™ Pulpdent (EW) and Voco Grandio Seal Voco (VG). Materials were placed in an incubator and heated for 72 hours at either 24°C, 40°C or 52°C. All materials were applied according to manufacturer's instructions. Completed restorations were thermocycled for 500 cycles with a dwell time of 30 seconds between 5°C and 55°C. Samples were immersed in 2% methylene blue dye for 8 hours, embedded in acrylic resin, sectioned bucco-lingually to expose 4 surfaces, and evaluated under stereomicroscope (Olympus, SZX16). A dye-penetration-to-sealant (DS) score was used: 0=0% DS, 1=1-50% DS, 2=51-100% DS, 3= >100% DS (fissure penetration). Counts and percentages were calculated. Statistical significance was assessed via Kruskal-Wallis tests ($p < 0.05$) for separate comparisons of materials and temperatures; Dunn's test with Bonferroni correction ($p < 0.017$) was used for post-hoc comparisons.

Results: Table 1 displays counts and percentages of microleakage scores. Table 2 displays p-values of comparisons between materials for each temperature. Table 3 displays p-values of comparisons between temperatures for each material.

Conclusions: At 24°C, material GC exhibited significantly greater microleakage than EW and VG. At 40°C, material VG exhibited significantly less microleakage than GC. At 52°C, material GC exhibited significantly less microleakage than EW and VG.

Table 1: Microleakage Counts and Percentages by Material and Temperature

Material	**Temp (°C)**	**DS Microleakage**			
		0	**1**	**2**	**3**
EW	24	5 (50%)	5 (50%)	0 (0%)	0 (0%)
EW	40	0 (0%)	3 (30%)	5 (50%)	2 (20%)
EW	52	0 (0%)	0 (0%)	2 (20%)	8 (80%)
VG	24	1 (10%)	8 (80%)	1 (10%)	0 (0%)
VG	40	2 (20%)	7 (70%)	1 (10%)	0 (0%)

VG	52	0 (0%)	0 (0%)	3 (30%)	7 (70%)
GC	24	0 (0%)	0 (0%)	3 (30%)	7 (70%)
GC	40	1 (10%)	0 (0%)	2 (20%)	7 (70%)
GC	52	2 (20%)	7 (70%)	1 (10%)	0 (0%)

Table 2: p-values of Comparisons between Materials for each Temperature

Temperature	**Kruskal-Wallis test**	**Post-hoc comparisons**		
		EW vs VG	**EW vs GC**	**VG vs GC**
24	< 0.001	0.212	< 0.001	0.001
40	0.001	0.026	0.152	<0.001
52	< 0.001	0.773	< 0.001	< 0.001

Table 3: p-values of Comparisons between Temperatures for each Material

Material	**Kruskal-Wallis test**	**Post-hoc comparisons**		
		24 vs 40	**24 vs 52**	**40 vs 52**
EW	< 0.001	0.007	< 0.001	0.053
VG	< 0.001	0.805	< 0.001	< 0.001
GC	< 0.001	0.755	< 0.001	0.001

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