- New Low shrinkage Dimer Acid based resin microhybrid composite physical properties
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A new "Low Shrinkage Microhybrid Composite (LSMHC)" was developed using a free radically polymerizable dimer acid based resin, designed at the University of Colorado, USA, which compensates for shrinkage by phase separation. The new dimer acid derived dimethacrylate readily copolymerizes with existing monomers to obtain dental composites using standard initiating systems.

Objectives: To determine the Physical Properties of the new LSMHC compared to commercially available products: Filtek Z100 (3M-ESPE), Image® (Septodont Inc.) and Esthet-X (Caulk-Dentsply)

Methods: Compressive and flexural strength, flexural modulus, depth of cure, water sorption and solubility were determined according to the International Standard ISO 4049 and ADA specification 27. Diametral Tensile Strength (DTS) was measured using a similar test method as compressive strength. Monomer conversion was calculated by near-IR. The polymerization shrinkage was measured using a linometer. Shrinkage stress was measured with an ADAHF Tensometer. Specimens were polymerized using a visible light lamp with an intensity of 500 mW/cm2, following the manufacturer instructions.

Results:

Physical Criteria	LSMHC	Z100	Image®	Esthet-X
Compressive strength, MPa	271±11	310±51	253±23	251±31
DTS, MPa	53±2	51±2	47±2	53±1
Flexural strength, MPa	114±6	160±26	113±11	102±8
Flexural modulus, MPa	6,520±577	12,882±2,375	6,870±1,386	7,725±1,795
Depth of cure, mm	2.30±0.02	2.70±0.03	2.50±0.04	1.97±0.02
C=C conversion, %	73.04±1.34	57.45±1.30	58.97±1.40	59.39±1.58
Polymerization Shrinkage, %	1.27±0.13	2.31±0.12	1.99±0.19	2.61±0.28
Shrinkage stress, MPa	1.65±0.07	2.37±0.12	1.97±0.06	2.26±0.07
Water sorption, µg/mm3	7.25±0.685	19.82±0.79	14.51±1.38	17.25±0.973
Water solubility, µg/mm3	0	0.61±0.08	0.24±0.07	0.91±0.625

Conclusions: The Dimer Acid based monomer system contributes to lower volumetric shrinkage and reduced stress at the bonding interface with the tooth, maintaining the strength. The monomer conversion is also increased, leading to a decrease in the water uptake.