Dental microscope filters improving visibility during light-curing composite application

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Objectives:
Operating microscopes use bright light sources with a wide visible spectrum decreasing working time of light-curing restorative materials. Orange filters prevent unintended polymerization with less visibility of tooth structures and restorations. Therefore it was the aim of the study (i) to assess the prolongation of working time of light-curing composites by experimental filters (ii), to improve operating visibility with white light (CRI=80) and (iii) to compare with traditional orange filters.

Material and Methods:
Three experimental filters (GF1-3), the standard orange filter (GFZeiss) and unfiltered xenon light (20 kx) of Zeiss OPMI Pico microscope were used. Composite materials with different photoinitiators were tested (Charisma/shade A2, Venus Diamond/A2: Heraeus, Hanau, Germany; GrandioSoA2: Voco, Cuxhaven, Germany; Tetric EvoCeram Bulk Fill/IVB: Ivoclar Vivadent, Liechtenstein). Prolongation over time was assessed every second with a vertical oscillating rheometer for each composite, each cycle was repeated 7 times. Prolongation factors for working time were defined at a viscosity level change of 50% and statistically analyzed using t-test and U-test. Photometrical analysis was provided for colour temperature and Colour-Rendering-Index (CRI).

Results:
New light filters extended the working time significantly. Prolongation factors: no filter = 1, glass filter 1 = 1.7 - 2.6, glass filter 2 = 2.5 - 4.3, Glass filter 3 = 1.2 - 1.8. The working time varied depending on the composite formulation. The orange filter allowed unlimited working time. Effect on light and colour conditions: the colour reproduction of the orange filter GFZeiss was poor due to the monochromatic light. The photometric analysis revealed the CRI for Xenon light > 90, for glass filter GF 1 = 88.1, for glass filter GF 2 = 88.6, for glass filter GF 3 = 89, for the orange filter GF Zeiss = out of range. Colour temperature was for Xenon 6000 K, for GF 1 = 3834 K, for GF 2 = 3778 K, for GF 3 = 3556 K and for the orange filter GF Zeiss = 2541 K. For GF 1 and GF 2 provided neutral white light colour with a good colour reproduction superior to the xenon light source.

Conclusions:
All three experimental glass filters prolonged the working time of dental restorative composite materials to a clinically acceptable level. The Colour Rendering Index (CRI) was improved to the value of neutral white light (GF1 and GF2) and warm white (GF3) providing clinically optimal distinction of different tooth structures and composite colours.