

Measurements of polymerization temperature of light-hardened dental materials by a thermal camera.

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During polymerization process, a large amount of heat is generated that warms the hard tissues of a tooth. The heat affects also the dental pulp and may increase its temperature to the dangerous level. So it is important to know the real polymerization temperatures of dental restorative materials.

In the paper the measurement method is presented, in which the temperature of restorative dental material is monitored by a thermal camera. Three materials were analyzed: Siloran A3, P60 A3 and Valux Plus A3. The samples of all materials were placed in holes 2mm in diameter drilled in 2mm thick teflon plate. The samples were illuminated by two polymerization lamps: a halogen and LED-based. The exposure time of 40 seconds was chosen according to the recommendations of the lamp manufacturers. The temperatures were monitored by a thermal camera operating in continuous recording mode. The recordings were conducted for all materials for both lamps. The results were analyzed, taking into account the emissive properties of measured materials [1,2]. The temperature changes on the surface of the samples versus time during illumination period were calculated (Fig 1.) as well as the maximum temperature values reached during polymerization for all tested materials (Table 1).

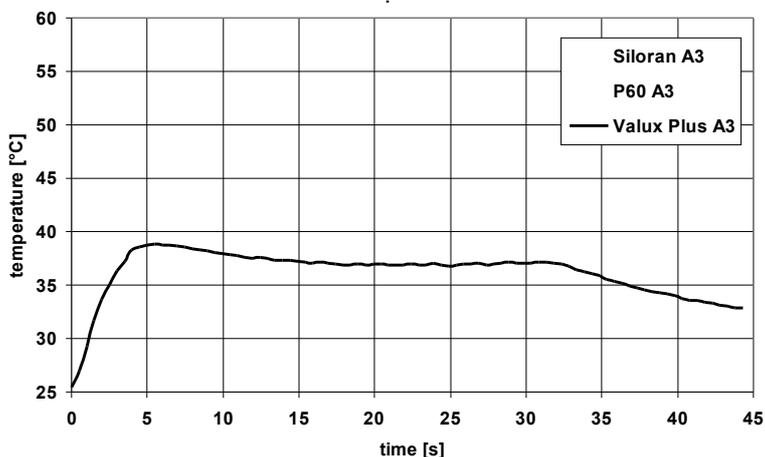


Fig. 1. Temperature changes during polymerization induced by LED-based lamp.

Table 1. Maximum values of polymerization temperature.

Filling material	Siloran A3	P60 A3	Valux Plus A3
	Temperature [°C]		
Halogen lamp	49,7	34,2	35,0
Lamp with LED diodes	58,4	37,7	38,8

On the basis of measurement results the expected temperature rise in hard tooth tissues was estimated caused by polymerization of restorative materials. It is clear, that temperature growth caused by heat generated during polymerization of filling material and transferred into surrounding tissues depends on the type of dental material and lamp used in the process. In order to avoid excessive temperature rise, the large cavities should be filled using small, consecutively applied and hardened amounts of dental material. It is particularly important in case of Siloran A3 compound, for which the temperature rise reached 24°C above ambient for halogen and about 33°C for LED-based lamp

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