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Thermoluminescence study on materials used in restorative dentistry for personal dosimetry applications

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The environment presents a plethora of radiation sources, both of natural, but mainly of human origin. The need to evaluate the dose threshold for biological effects has led to the development of the area of dosimetry. Accidental dosimetry deals with the quantification of the dose absorbed after an accident. Studies focus on materials in the immediate vicinity of human. Materials which meet this requirement are restorative dentistry materials that present the advantage that sampling does not require irreversible surgery.

The aim of the present study, which is included in the area of ionizing radiation, is of a dual nature. It aims on establishing the materials used in restorative dentistry as objects of personal accidental dosimetry, but also to establish luminescence techniques as innovative methods for the discrimination between materials with different stabilizers. The study is performed on two materials with different composition. Both of them are monolithic zirconia, but they differ in the amount of stabilizer in their synthesis, which is used to maintain high toughness. The applied methodology starts with the preparation of specimens. As a second step, the structural characterization studies are carried out in all specimens. Finally, the dosimetric study is performed with thermoluminescence (TL) measurements, in order to check the luminescence stability of the materials after successive cycles of irradiation and heating, the dose response and the lower detectable limit, since these are the most important aspects that should be studied for a potential personal accidental dosimeter.

The results seem promising, and they are also compared to existing studies on similar materials [1,2]. They aim to the establishment of dental restorative materials as personal passive/accidental dosimeters. The goal of this general project is to study all restorative dental materials in the same direction, for a complete data base.

References

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2. I.K. Sfampa et al., Radiat. Meas. 125, 7 (2019).

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