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Radiopacity of different pulp capping materials using Prodigy DXA system

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Introduction: The radiopacity of restorative materials is listed as one of the basic requirements for accurate diagnosis and follow-up in restored teeth. Aluminum stepwedge commonly used to standardize radiopacity does not provide punctual measurements thus resulting a subjective method of analysis. Prodigy DXA system provide densitometric analyses on the basis of a dual energy X-ray absorptiometry (DXA), that is the absorption and the interaction between incident photons and the material. As the traditional radiology the Prodigy DXA system provide bi-dimensional images of the irradiated surfaces overlapping the changes in density inside the material; however the inclusion of collimation filters, which allow the emission of a single beam through the material, reduces the missing radiations and improve the resolution of the measurements. The objective of the present study was to compare the radiopacity of different pulp capping materials using an experimental densitometric evaluation (Prodigy DXA system).

Materials and Methods: Thirty specimens were prepared for each material (Dycal Ivory - Dentsply, Dycal Dentin - Dentsply, Calcimol LC - Voco, MTA-Angelus - Angelus, Biodentine - Septodont, ProRoot MTA - Dentsply) following manufacturer's instructions. Dentin slices were obtained from freshly extracted premolar teeth. All materials were scanned on a GE Healthcare Lunar Prodigy and iDXA in routine clinical manner according to International Society for Clinical Densitometry (ISCD) recommendations and data were collected. The assessment of normality was developed with Shapiro-Wilk test ($P < 0.05$), while comparison between means were conducted using ANOVA with Tuckey test to adjust for multiple comparison (level of significance of $P = 0.05$).

Results: The null hypothesis that the distributions is modeled as a normal was confirmed with Shapiro-Wilk test at a level of significance of $\alpha=0.05$. All the materials showed a mean densitometric value significantly higher than dentinal tissue ($P < 0.05$). ProRoot MTA and MTA Angelus showed the highest values of density when compared with the other materials ($P < 0.05$). Significant differences were collected also between Calcimol LC and Dycal Ivory ($P < 0.05$) and between Calcimol LC and Dycal Dentin ($P < 0.05$).

Discussion: The dependence of dental diagnosis on radiographs makes it important for all materials used in the oral cavity to be radiopaque: they can thus be identified and distinguished from dental structures. In the present study materials containing bismuth oxide showed high densitometric values when compared with resin-based materials and with materials containing zirconium oxide and zinc oxide.

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