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# Nanocharacterization of dental materials by atomic force microscopy and their thermal degradation evaluation

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**Abstract:** The restorative dental materials must be produced with special characteristics because these are operating in an environment medium with different humidity and temperature. These day-to-day factors play an important role in the lifetime of such dental restorative materials. Resin composites have been by far the most successful in dental applications by meeting several stringent design requirements difficult to achieve with homogeneous materials such as ceramics and metal alloys. Mechanical and tribological properties of direct restorative filling materials are crucial not only to serve and allow similarity with human enamel and dentine but also to compare composites between them and determine objective criteria for their selection. The objective of this research work is to investigate the mechanical and tribological properties of some commercial restorative materials using the atomic force microscopy technique as a function of the operating temperature. Therefore, restorative materials are expected to replace and perform as natural tooth materials. The demand of achievement it is so great that most of the times restorative filling materials replace enamel and dentin, which have very different mechanical properties, namely hardness and elastic modulus. The scope is to estimate the lifetime of such materials starting from their nano-behaviors as nano-wear, nano-friction, nano-mechanical tests. Concluding, the nanoindentation is an attractive method for measuring the mechanical behavior of small specimen volumes in dental hard materials. Using this technique, the mechanical and tribological properties of nanocomposite resins were investigated. This technique evaluates only the tribo-mechanical properties of a very shallow surface region of a specimen that may have undergone damage associated with mechanical preparation required to achieve a satisfactory flat sample for testing. Experimentally study has been carried out with several normal loads and time-duration tests i.e., representing several steps of severity conditions for materials under investigation.

**Keywords:** dental materials; temperature effect; hardness; modulus of elasticity friction; wear; adhesion effect