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Editorial

Special Issue on the Advance of the Mechanical Properties of Dental Materials

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Abstract: In the oral environment, restorative and prosthetic materials and appliances are exposed to chemical, thermal and mechanical challenges. The mechanical properties of a material define how it responds to the application of physical force. This Special Issue focuses on all the recent technology that can enhance the mechanical properties of materials used in all of the different branches of dentistry. This Special Issue is closed, but the topic is certainly of interest, and therefore new research will be needed to explore further evolution in dental materials.

Keywords: mechanical properties; dental materials; prosthodontics; restorative dentistry

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In the oral environment, restorative and prosthetic materials and appliances are exposed to chemical, thermal and mechanical challenges. The mechanical properties of a material define how it responds to the application of physical force. The mechanical properties that are of huge importance in dentistry include brittleness, compressive strength, ductility, elastic modulus, fatigue limit, flexural modulus, flexural strength, fracture toughness, hardness, impact strength, malleability, Poisson's ratio, shear modulus, shear and tensile strength, torsional strength and Young's modulus. All of these are measures of the resistance of materials to deformation, crack or fracture, under an applied force or pressure. Measured responses can be elastic (reversible on force removal) or plastic (irreversible on force removal).

Recent advances in nanotechnology and 3D printing have rapidly spread and manufacturers are continuously developing new materials and solutions to provide high-quality dental care, with particular attention being paid to long-term follow-up. Restorative dentistry, prosthodontics, oral surgery, implants, periodontology, and orthodontics are all involved in this continuing evolution.

This Special Issue focuses on all the recent technology that can enhance the mechanical properties of materials used in all of the different branches of dentistry. It aims to collect and present all the innovations in the different dental specialties.

A total of seven original articles were published in various fields. Di Fiore et al. [1] compared the fracture strength and the different types of failure on anterior cantilever RBFDPs fabricated using zirconia (ZR), lithium disilicate (LD), and PMMA-based material with ceramic fillers (PM) by the same standard tessellation language (STL) file and concluded that within the limitations of this in vitro study, we can conclude that the zirconia RBFDPs presented a load resistance higher than the maximum anterior bite force reported in the literature (270 N) and failure type analysis showed some trends among the groups.

Puleio et al. [2] reported that sandblasting is the best treatment to increase the surface roughness of a supra-nano-composite.

Mi et al. [3] investigated the fracture properties of concrete in dry environments with different curing temperatures (5, 20, 40, and 60 °C) and concluded that the optimum temperature suitable for the development of concrete fracture properties under dry conditions was around 40 °C.

Bruno et al. [4] compared the stress effects developed on the periodontal ligaments and teeth using three different types of mandibular advancement devices (MADs) using finite element method (FEM) analysis. This research concluded that devices with a bilateral mechanism generate less and more distributed stress than an anterior connecting rod mechanism. Therefore, they may be advisable for patients with compromised periodontal conditions in the anterior area.

Szalewski et al. [5] aimed to analyze the fatigue properties of a dental composite reinforced with polyaramide fibers under the influence of a cyclic, vertical load, and for this purpose, they designed a thermoformable template, corresponding to the construction of adhesive bridges in the side section of the jaw. This study showed that the samples from the control group required the greatest force to break in relation to those subjected to the work cycles. The maximum force in the control (K) group was 738.1 N; in R1 this was 487.8 N, and in R2 451.4 N. The determined algorithm showed a change in deflection associated with the increase in force value. This study did not show any relationship between the type of sample fracture and the number of load cycles.

Wang et al. [6] investigated the anisotropic mechanical properties of rolled AZ31 magnesium alloys using nanoindentation tests at room temperature. The data obtained through the above experiments were used to determine the parameters in the new criterion. Finally, a solution to the challenge of modeling a function that accurately describes the anisotropic yielding behavior of AZ31 magnesium alloys is proposed using the nanoindentation technique to solve the requirements of specimen size and experimental methods of the macro test.

Szalewski et al. [7] aimed to assess the temperature rise values and flexural strength of composite materials, as obtained using different modes and times of polymerization and concluded that in the case of deep caries with a thin layer of dentin separating the filling from pulp, a base layer or a short polymerization duration mode is recommended to protect pulp from thermal injury.

This Special Issue is closed, but the topic is certainly of interest, and therefore new research will be needed to explore further evolution in dental materials.

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