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# Possibilities for Biomechanical Investigation of Different Dental Biomaterials and Dental Tissues

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A large number of previously conducted studies have documented an application of various methods for investigation in the dental biomechanics. Different bio-tissues (bone, artificial bone, teeth) and biomaterials served for conservative and prosthetic restorations (acrylics, glass ionomers, composites, alloys, metal-ceramics, all-ceramics) were tested using in vitro and in vivo models proposed in the past. Measurements were done to find, analyze and determine stress/strain/displacement fields as related parameters for mechanical behavior of these biomaterials and bio-tissues. In the very first beginning, these studies were performed employing strain gages and other 2D methods as startup reliable methods for biomechanical investigation. Additionally, optical methods such as Binocular Stereovision, Laser-Speckle Interferometry, Photorefractive Holographic Interferometry Technique and Optical Metrology were introduced to facilitate stress/strain optical performances. Mentioned optical methods represented full stress/strain field of the measured objects. Current 3D methods for full field 3D strain measurement such as Cone Beam CT, the Finite Element Analysis (FEA) and the Digital Image Correlation Method (DIC) found broad application especially considering qualitative and quantitative analyses. Nevertheless, FEA and DIC were distinguished as the most popular methods regarding their possibility for in vitro set ups which exclude ethical moment. Although, few studies indicated that both, FEA and DIC shown similarities in stress/strain evaluation, indicating that both techniques can serve to verify each other, more studies have to be performed to find the relationship between these two techniques. In addition, both methods have negative sides; FEA include universal characteristics of materials (average data) while DIC is claimed to be a surface method. Thus, future investigations in dentistry research field considering large number of samples/specimens will reveal the real nature of their overlapping.

An introduction of additional optical spectroscopic techniques, e.g. Raman and photoluminescence scanning tunneling microscope (STM); X-ray photoelectron spectroscopy (XPS); Transmission electron microscopy (TEM); Fourier Transform Infrared Spectroscopy, also known as FTIR Analysis could help in creating the real picture of mechanical and micro-structural behavior of dental bio-tissues and biomaterials.

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