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EC DENTAL SCIENCE
Editorial

Required Manufacturing Procedures for Zirconia CAD/CAM Restoration

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Received: March 23, 2017; **Published:** April 17, 2017

The properties of the zirconia (ZrO_2) substructures could depend by the manufacturing process. The fabrication of the framework of monolithic ZrO_2 requires rapid prototyping procedures such as milling with a computer aided design and manufacturing (CAD/CAM) [1]. The different manufacturers use milling-machines directly in the dental laboratories. The process starts with optically digitizing the clinical abutment with an intraoral camera or with 3D-scanning devices using gypsum models or wax models. Afterwards the substructure is designed on the computer and the core is anatomically shaped to support the ceramic veneering material. In the last few years the use of zirconia as monolithic restoration has increased. The use of insufficient preparations, or frameworks with imprecise dimensions, thickness could reduce the integrity of ZrO_2 restorations. The design of the core, when it is a simple cap or an occlusal supporting design has a strong influence on the lifetime of the veneering [2,3]. Based on the assumption that the clinically acceptable marginal fit extends to 200 µm, CAD/CAM fabricated restorations values between 64 - 83 µm and 245 µm are in most cases acceptable [4,5]. CAD/CAM ZrO_2 dental frameworks can be produced according to two different techniques: soft machining of pre-sintered blanks or hard machining of fully sintered blanks [6]. The soft machining process is the most diffused manufacturing system for 3Y-TZP, based on milling of pre-sintered blanks. The pre-sintered blanks, at the so-called green state, are produced by compacting ZrO2 powders along with a binder through a cold, isostatic pressing process. The die of the supporting abutments or the wax patterns of the crown, fixed dental prostheses were scanned. After scanning, a virtual, enlarged framework is designed by sophisticated computer software (CAD). Then, through a CAM milling procedure; a framework with enlarged, accurately controlled dimensions is machined out of the blank. Software limitations and accuracy of milling devices may affect the fit of CAD/CAM restorations [7]. Most clinicians agreed that marginal gap should not be greater than 100 µm [8,9]. It has been reported that restorations produced by CAD/CAM systems can have marginal gaps of 10 - 50 µm which are considered to be within the acceptable range [10,11]. A variety of CAD/CAM systems have been applied to the total process for fabricating restorations. The intra-oral abutment was scanned by an intraoral digitizer to obtain an optical impression. Digitized data was reconstructed as a 3-D graphic on the monitor and the optimal morphology for the FDPs was virtually designed on the monitor. Real FDPs were fabricated by milling a block using a numerically-controlled machine. Since there were difficulties in digitizing the intra-oral abutment accurately using a direct intraoral scanner, we decided to prepare a conventional stone model to begin the CAD/CAM process for the fabrication of crowns, especially for dental laboratory use. Different digitizers such as a contact probes, laser beam with position sensitive detectors, and lasers with a CCD camera were developed. In addition, sophisticated CAD software and compact dental CAD/CAM machines were developed for metallic and ceramic restorations by the second-generation CAD/CAM systems. Recently, Gautam., *et al*. highlights the CAD/CAM used in zirconia supraconstruction [12].

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Volume 9 Issue 5 April 2017