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Dental Materials and their Innovation in Digital Dentistry

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Abstract

Dental materials have been studied since the beginning of dentistry. Today, with the development of new technologies based on computer-aided design and computer aided manufacturing (CAD/CAM), continuously new and improved materials are presented. The study of the materials, independent of their manufacturers is indispensable to generate suitable criteria of selection for clinicians and dental technicians. In this article opinion, the evolution, clinical and laboratory applications, properties, methods of study and the perspective of CAD/CAM materials are focused from an independent point of view.

Keywords: Cad-cam materials; Digital dentistry; Dental materials

Opinion

The digital dentistry era is a reality. From the administrative management of a clinic through software, to the completion of a surgical guide for the placement of implants, there is a sequence of procedures involving digital files. In restorative dentistry, this has been no exception. The subtractive cad-cam technology for the manufacture of restorations in one visit, led by the chairside systems, has played a crucial role for the evolution of the digital dentistry in oral rehabilitation [1]. The dental materials have not been unaware of this evolution either. However, along with this advance new materials have been introduced in the dental market. Therefore, the knowledge of the dentist and the dental technicians about the new materials is essential for their proper selection and application. To make the restorations in a single visit, the feldspathic ceramics were the most used material in the beginning of the digital era [2]. The failure rate reported due to its low resistance [3], forced the development of more resistant materials with a greater crystalline phase [4] (lithium disilicate glass ceramic and zirconia reinforced lithium silicate ceramic). of milling materials in presintered crystalline intermediate state. In order to achieve better esthetic results, individual characterizations of the restorations can be applied by means of stains and glaze materials or characterized with partial veneered ceramic. To replace the metal copings, all-crystalline materials (sintered zirconium oxide ceramic and yttrium-stabilized zirconium oxide) were designed to make copings on which the powder/liquid glass-based material could be veneered. These materials are recommended for clinical situations of high masticatory impact such as fixed bridges in the posterior sector. Optimization of time for both dentists and technicians has been a key factor in incorporating esthetic, resistant and machinable monolithic materials in less time (highly translucent sintered zirconium oxide ceramic). The dental materials used for temporary restorations based in polyetheretherketon (PEEK) and cross linked polymethylmethacrylate (PMMA) have also undergone a great evolution by increasing their density, with lower porosity, more polished surfaces, and with improved optical properties [5]. Restorative dental materials used for CAD/CAM systems can be ceramic-based and composite resin-based. Although ceramic materials have evolved enormously, the need to replace dental tissues with less invasive restorations and with less fragile and rigid materials, have been currently introduced [6]. CAD/CAM resin-based composites have also been incorporated as a predictable clinical solution with better biomechanical properties that resembles the elastic modulus of the dentin and better resistance to crack propagation. Hybrid materials also constitute a novelty within the field of dental materials as they incorporate a ceramic matrix infiltrated with polymers so that they combine the advantages of the two materials and attenuate their disadvantages [7].The CAD/CAM materials for restorative dentistry are repairable and perform well against masticatory loads in normal ranges [8]. Among them, they do not present enormous differences, so their use is perfectly indicated for partial and total coronary restorations.Modern materials have specific features in optical properties for certain clinical scenarios where low translucency (LT), high translucency (HT), medium opacity

(MO) or different chromaticity from cervical to incisal are required. Lastly, CAD/CAM systems also use transparent or calcinable materials to check the fit, size, morphology of the restorations on softer materials that can then be sent to the laboratory for injection or casting. These materials used with CAD/CAM techniques have shown comparable results with conventional lost wax technique [9]. Researching CAD/CAM materials in presentation of blocks to be milled also are a challenge. To analyze its microstructure and its physical properties, they present specific characteristics to design the specimens. Therefore, they require special investigation protocols, different in some cases from those that are governed by international standards [10]. New methods of studying and analyzing CAD/CAM materials properties are under development so that soon we can contrast the information of manufacturers with independent studies tested by modern technologies.

Conclusion

Dental materials will continue to evolve. The ideal material, however, does not exist and does not equal enamel and dentin. For this reason, the knowledge and application of techniques where the wear of healthy dental tissue is the minimum necessary to obtain a predictable long-term restoration are indispensable. More research on the clinical behavior, clinical applications and biomechanical characterization of the new dental materials is necessary for the best understanding and adequate selection for the clinicians and dental technicians.

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