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Applications of PEEK in Dentistry

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Abstract

Polyetheretherketone (PEEK) is a high-performance polymer with favorable physical, mechanical, and chemical properties that has recently been used in dentistry. The processing properties of PEEK complement the use of digitization to create patient-specific prosthetics. PEEK is one of the materials that could be used in dental applications to replace titanium and zirconia. It is suitable for use as dental implants, abutments, and removable partial dentures.

Keywords: Implants; PEEK; Polymers; Prosthodontics

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Introduction

Evaluation of existing research on PEEK materials to determine if they have desirable properties and can improve Osseo integration, allowing them to be used as implant materials and in digital prosthodontics. To find research on the use of PEEK for the fabrication of CAD-CAM prostheses, electronic database searches were conducted using the words "PEEK", "dentistry" and "CAD-CAM" [1]. The quest took place between January 1990 and February 2020. In May 2018, an electronic and organized systematic search was conducted in the Medline, Scihub, Ebscohost, Cochrane, and Web of Science databases, with no time constraints. In English, both *in vivo* and *in vitro* studies were eligible. To identify the included journals, review articles and their references were checked [2].

Literature Review

In the last 15 years, dental technology has discovered the flexible material polyetheretherketone, which is now used as a scaffold material in CAD- CAM. In an in vitro study, three-unit fixed dental prostheses milled using CAD-CAM technology from pre-pressed PEEK blanks demonstrated less deformation and higher fracture loads (2354 N) than those pressed in granular form (1738 N) [3]. Due to its low modulus of elasticity, PEEK allows the absorption of functional stresses by deformation and acts as stress breaker reducing forces transferred to the abutment teeth. Another in vitro study comparing various types of inlay-retained FDPs discovered that PEEK had the highest load bearing capacity when compared to PMMA, composite resin paste, and fiber-reinforced composite materials. The majority of the studies concluded that when PEEK surfaces are pretreated and conditioned using adhesive systems containing methylmethac-monomers, such as Signum PEEK bond, reliable bond strength to composite veneering resins and luting cements can be achieved [4].

Discussion

PEEK demonstrated the lowest solubility and water absorption values after ageing in different solutions when compared to composite resins, a hybrid material, and PMMA-based materials [5]. As an alternative to conventional Co-Cr frameworks, PEEK frameworks with acrylic resin denture teeth and heat-cured acrylic resin denture bases are used. Another study described the use of milled PEEK frameworks for the fabrication of removable maxillary obturator prosthesis [6]. Therefore, studies reported high patient satisfaction with regard to aesthetics, retention and comfort. PEEK was also suggested as a material for CAD-CAM fabricated occlusal splints. In an in vitro study, Benli et al. discovered that PEEK occlusal splints lost less volume and changed in roughness after chewing simulation than other CAD-CAM materials such as polymethyl methacrylate (PMMA), polycarbonate (PC), and polyethyleneterephthalate (PETG).

PEEK can be used for a variety of dental applications, including dental implants, due to its mechanical and physical properties that are similar to bone and dentin. Because of its superior properties, PEEK is also an appealing material for the fabrication of CAD-CAM fixed and removable prostheses.

Conclusion

Because of its favourable mechanical, chemical, and physical properties, several in vitro studies and clinical reports suggested that PEEK could be suitable for CAD-CAM fabricated fixed and removable dental prostheses. However, additional in vitro and clinical studies are required to assess the long-term performance of these prostheses before PEEK can be safely recommended as an alternative to well-established materials.

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