Corrosion and corrosive wear of DLC and DLC with silver nanoparticles (DLC-Ag) for prosthesis applications

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Metals and their alloys are very important for orthopedic applications, and the basic requirements for successful application of an implant are: chemical stability, mechanical behavior, and biocompatibility in body fluids and tissues [1]. For prosthesis application, the corrosion resistance of metals is one of the major prerequisites[2]. DLC (Diamond-Like Carbon) films have been extensively studied due to their properties that can increase biocompatibility and protect the prosthesis from corrosion. Additionally, DLC coating can be used on Ti6Al4V prosthesis to prevent the substrate from eluting Al and V by plastic deformation and corrosion and silver nanoparticles may also possess antimicrobial and anti-inflammatory properties [3]. This paper is about corrosion and corrosive wear studies on DLC and DLC-Ag (DLC containing silver nanoparticles) on Ti6Al4V substrates. DLC and DLC-Ag films were obtained by PECVD by using hexane as carbon and hydrogen precursor and silver nanoparticles dispersed on hexane for DLC-Ag films. The corrosion and corrosive behavior of bareTi6Al4V covered with DLC and DLC-Ag was investigated in reciprocating mode in Ringer's lactate solution and the potential was varied in a range that corrosion was observed on the bare sample, viz. from −2.5VAg/AgCl to 2.5VAg/AgCl. From polarization test results, the protective efficiency of the film was calculated. Silver nanoparticles improved the corrosion resistance of the films. The protective efficiency was 78 and 85% for DLC and DLC-Ag films, respectively.

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