齿科植入器械微动损伤及界面强化的研究进展 *

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摘 要: 种植体与骨界面发生微动疲劳、连接部件界面发生微动磨损等破坏现象是齿科植入器械的主要失效形式之一, 因此减小微动、提高齿科植入器械的长期寿命成为这类器械发展的关键。本文重点阐述了种植体与骨组织界面微动疲劳损伤导致骨结合不牢固、种植体内部连接界面微动磨损导致连接松动、失效等问题的研究进展。表面改性技术在提高植入器械骨结合率、耐磨损、抗疲劳等方面发挥着关键性的作用, 传统的涂层技术由于增加了界面、存在长期脱落的风险而逐渐退出了历史舞台。对目前相关领域的综述研究表明, 齿科植入器械各部件的原位改性技术具有从表面到基底成分梯度渐变、长期结合力好等优点, 是有效解决植入器械微动损伤的关键技术, 逐渐成为了新的发展趋势。

关 键 词: 齿科植入器械; 微动损伤; 表面改性; 耐磨损; 抗疲劳

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Research Progress of Fretting Damage and Interface Strengthening in Dental Implant System

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Abstract: It is one of the main failure modes for dental implant system that fretting fatigue occurs at the implant-bone interface and fretting wear occurs at the interface between the connection components. Therefore, reducing the micromotion and improving the longevity of implant system have become the key factors for successful application. This review article focuses on the research progress of the instable problems caused by fretting fatigue at the implant-bone interface and the connection failure due to fretting wear between the internal interfaces of implant system. Surface modification technology plays a key role in improving osseointegration rate, wear resistance, and fatigue resistance of implanted devices. However, all the traditional coating technology gradually withdrew from the historical stage due to the increased new interface and the risk of long-term shedding. Based on the review for current researches, it is believed that some modern techniques (such as low energy ion implantation methods) have many advantages, such as gradient composition change from top surface to body substrate, long-term stability, and so on, which are becoming the key technologies for fretting damage control and are becoming a new trend in biomedical device development.

Key words: dental implant; fretting damage; surface modification; wear resistance; fatigue resistance

在医疗器械的发展过程中, 长期植入人体的三类医疗器械是医疗器械发展的主力, 也是难点。长期植入器械是指那些植入人体后不再取出或者没有必要取出的器械, 主要有齿科用种植体和骨科用种植体等。这些器械由于植入部位的组织无法再生或者取出手术非常危险, 因此在植入后就不会再次取出(除非发生了失效而无法继续实现功能)。这类器械最大的特点就是在人体中长期植入, 需要的使役寿命非常长, 长达几十年。在使用过程中, 常常会出现植入器械与骨结合松

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