Chapter 3
Bioresorbable Composites and Implant

Divya Zindani
National Institute of Technology Silchar, India

ABSTRACT

Different biomaterials in the form of ceramics, metal alloys, composites, glasses, polymers, etc. have gained wide-range acceptance in the realm of medical sciences. Bioimplants from such biomaterials have been constructed and used widely for different clinical applications. With the continual progress, biomaterials that may be resorbed inside the body have been developed. These have done away with the major challenge of removal of an implant after it has served its intended function. Important factors are taken into consideration in design and development of implants from such biomaterials are mechanical properties, degradation rate, surface modification, rate of corrosion, biocompatibility, and non-toxicity. Given the importance of such materials in clinical applications, the chapter presents an overview of the bioresorable composites and their implants. The related properties and the functions served have been outlined briefly. Further, the challenges associated and the remedies to overcome them have also been delineated.

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INTRODUCTION

Progressive research and advancements in medical sciences have resulted in the development of implants for human body. The implants that replaces or assists in functioning of a human organ are referred to as bioimplants (Soler-Botija et al., 2014). Various bioimplants such as cosmetic implants (Yahyavi-Firouz-Abadi et al., 2015), dental implants (Klein et al., 2014), subcutaneous implants (Guo et al., 2015), organ stimulation implants (Oka et al., 2015), sensory implants (Huang et al., 2015), neural implants (Takmakov et al., 2015), spinal implants (Bagga et al., 2017) and other structural implants such as braces, hip prosthesis etc. have been widely applied in the medical milieu to suit different applications. Given the quantum of road accidents as well as the trauma injuries, an upsurge in the usage of bioimplants can be predicted.

Biomaterials for bioimplants can be categorised into: single crystals, polycrystals, polymers, composites, bioceramics and glass-ceramics (Shackelford, 1999). The inherent nature of a biomaterial is dominant in deciding the type and mechanism of their interaction with the adjacent tissue surface. An implant may be biotoxic if the surrounding tissue dies, bioactive and nontoxic, bioinert and nontoxic and bioresorable in which case it dissolves to replace the surrounding tissue. Resorable bioceramics (Shikinami and Okuno, 1999) degrade with time and therefore replace the existing surrounding tissue. Major challenges associated with bioresorable bioceramics is that of maintenance of strength and stability throughout their lifetime. Some of the important characteristics desired to be possessed by a bioactive and nontoxic bioceramics are biocompatibility, osteoinductivity, osteoconductivity, biodegradability and the flexibility to acquire different shapes. A very well-known class of material that is used predominantly in the tissue engineering applications are calcium phosphates bioceramics having similar mineral content to that of bone.

Continual advancements in the development of bioresorable implants have led to their wider acceptability than the metallic biomaterials in sports related traumas and injuries (Weiler et al., 2000). Disadvantages such as inflammatory reactions, distortion of metallic screws and other postoperative complications are associated with metallic biomaterials. Polymeric materials are used as bioresorable materials for drug delivery devices and bone implants (Vert, 2009).

Bioresorable materials in the form of metallic alloys have also been considered for medical strength owing to them having higher stiffness and

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