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Improving biocompatibility of implantable metals by nanoscale modification of surface

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The human body is an intricate biochemical –mechanical system, with an exceedingly precise hierarchical organisation in which all components work together in harmony across a wide range of dimensions. Many fundamental biological processes take place at surfaces and interfaces, and these occur on the nanoscale. The ultimate aim is to produce and enhance the natural nanoscale elements present in the human body (biometic) and to thereby develop new material with improved biological activities. Materials used for load-bearing implants must be mechanically strong and must possess high resistance to corrosion and wear and should not weaken the mechanical strength and release potentially dangerous metallic ions or debris in the human body. The most used ones are stainless steels (such as 316L) as well as titanium and its alloys (e.g., TiAI) and shape memory TiNi alloys used in orthopaedic and cardiology. The most popular and efficient ways to modify surfaces on the nanoscale involve direct chemical modifications with acids and oxidants ,because they are efficient and uniform access to all surfaces even on multifaceted devices with complex 3D shapes. Acid –etching produces micro pits on titanium surfaces with sizes ranging from .5 to 2 micrometer in diameter .Acid etching has been shown to greatly enhance osseo integration, immersion of titanium implants for several minutes in a mixture of concentrated HCL, H_2SO_4 heated above 100°C (dual acid etching) was employed to produce a microrough surface . Implants treated by dual etching have specific topography able to attach to fibrin scaffold, higher bone to implant contact and less bone resorption with dual acid etched surfaces .These characteristics make chemical treatments an advantageous and flexible way to modify biomaterials for implants.

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