A 16-year study of the microgap between 272 human titanium implants and their abutments.


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Abstract

A microgap has been described at the level of the implant-abutment connection. This microgap can be colonized by bacteria, and this fact could have relevance on the remodeling of the peri-implant crestal bone and on the long-term health of the peri-implant tissues. The authors report on 272 implants with screw- or cement-retained abutments retrieved from humans for different causes during a 16-year period. In the implants with screw-retained abutments, a 60-microm microgap was present at the level of implant-abutment connection. In some areas the titanium had sheared off from the surface and from the internal threads. The contact between the threads of the implant and those of the abutment was limited to a few areas. Bacteria were often present in the microgaps between implant and abutment and in the internal portion of the implants. In implants with cement-retained abutments, a 40-microm microgap was found at the level of the implant-abutment connection. No mechanical damage was observed at the level of the implant or of the abutment. All the internal voids were always completely filled by the cement. No bacteria were observed in the internal portion of the implants or at the level of the microgap. The differences in the size of the microgap between the two groups were statistically significant (P < .05). In conclusion, in screw-retained abutments the microgap can be a critical factor for colonization of bacteria, whereas in cement-retained abutments all the internal spaces were filled by cement. In these retrieved implants, the size of the microgap was markedly variable and much larger than that observed in vitro.

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An overview of the corrosion aspect of dental implants (titanium and its alloys).


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Abstract
Titanium and its alloys are used in dentistry for implants because of its unique combination of chemical, physical, and biological properties. They are used in dentistry in cast and wrought form. The long term presence of corrosion reaction products and ongoing corrosion lead to fractures of the alloy-abutment interface, abutment, or implant body. The combination of stress, corrosion, and bacteria contribute to implant failure. This article highlights a review of the various aspects of corrosion and biocompatibility of dental titanium implants as well as suprastructures. This knowledge will also be helpful in exploring possible research strategies for probing the biological properties of materials.

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Fretting corrosion behaviour of ball-and-socket joint on dental implants with different prosthodontic alloys.

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Abstract

The fretting corrosion of five materials for implant suprastructures (cast-titanium, machined-titanium, gold alloy, silver-palladium alloy and chromium-nickel alloy), was investigated in vitro, the materials being galvanically coupled to a titanium ball-and-socket-joint with tetrafluoroethylene under mechanical load. Various electrochemical parameters (E(corr), i(corr), Evans diagrams, polarization resistance and Tafel slopes) were analyzed. The microstructure of the different dental materials was observed before and after corrosion processes by optical and electron microscopy. It can be observed that the mechanical load produces an important decrease of the corrosion resistance. The cast and machined titanium had the most passive current density at a given potential and chromium-nickel alloy had the most active critical current density values. The high gold content alloys have excellent resistance corrosion, although this decreases when the gold content is lower in the alloy. The palladium alloy had a low critical current density due to the presence of gallium in this composition but a selective dissolution of copper-rich phases was observed through energy dispersive X-ray analysis.
Load fatigue performance of implant-ceramic abutment combinations.

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Abstract

PURPOSE: The mechanical properties and functional load performance of implant restorations coupled with metal abutments have been studied widely. However, the fatigue performance of the newly introduced ceramic implant abutments has not been reported. This study investigated the load fatigue performance of four implant systems and their corresponding zirconia ceramic abutments at the manufacturers' recommended torque levels.

MATERIALS AND METHODS: Three different diameters (narrow, regular, and wide) of the Replace Select and Branemark systems and two different diameters (4.1 mm and 5.0 mm) of the Osseotite NT and Osseotite NT Certain systems provided 10 implant-abutment test groups. The abutments tested were Procera zirconia, Zirael posts, and Certain ZiReal posts. Each group had a sample size of five. A rotational load fatigue machine applied a 21-N load to the specimens at an angle of 45 degrees to produce an effective bending moment of 35 Ncm at a test frequency of 10 Hz. The number of cycles to failure was recorded.

RESULTS: Twenty-nine of the 50 implant-abutment combinations tested failed. Eighteen abutments fractured. Seven implant fractures and 16 abutment screw fractures were seen, along with some damage to the implant platform in some specimens. No significant difference was seen between the implant systems, but significant differences were observed between the implant diameters. A subsequent one-way analysis of variance revealed statistically significant differences between the 10 implant-abutment test groups.

CONCLUSIONS: Rotational load fatigue testing performance of zirconia abutments is dependent on the abutment diameter. Failure modes varied according to system design characteristics.
The effect of particle phagocytosis and metallic wear particles on osteoclast formation and bone resorption in vitro.

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Abstract

Osteoclasts are multinucleated bone-resorbing cells that are formed from precursors that circulate in the monocyte fraction. This study has determined the effect of phagocytosis of metal particles on osteoclast formation and bone resorption in vitro. Human peripheral blood monocytes were cocultured for 21 days with osteoblast-like UMR 106 cells, in the presence of 1,25-dihydroxyvitamin D3, dexamethasone, and human macrophage colony-stimulating factor. Cobalt-chrome alloy (CoCr), stainless steel (316L-SS), titanium alloy (TiAlV), and commercially pure titanium (cpTi) particles (size range, 0.5-3.0 microm) and 1.0-microm latex particles were added to the cocultures as a single dose at the beginning of each experiment. All 5 types of particles were readily phagocytosed by the monocytes. After 4 days' exposure to high concentrations of all the metal particles, some cell death was found in the cocultures. After 14 days, a reduction in the number of CD14+ cells was seen in cocultures exposed to high concentrations of metal particles, particularly CoCr and 316L-SS particles. Phagocytosis of latex particles by osteoclast precursors did not affect the ability of these cells to undergo osteoclast differentiation. In contrast, exposure to metal wear particle preparations caused a dose-dependent reduction in the number of vitronectin receptor-positive osteoclastic cells formed and a dose-dependent reduction in the bone resorption produced by these cells. This decrease in resorption was greater after exposure to CoCr and 316L-SS particles compared with TiAlV and cpTi particles. This in vitro cell culture system may provide a useful model to compare the effect of different prosthetic materials on human osteoclast formation and bone resorption.