Titanium allergy: could it affect dental implant integration?

Siddiqi A, Payne AG, De Silva RK, Duncan WJ.


Abstract

Purpose: Degradation products of metallic biomaterials including titanium may result in metal hypersensitivity reaction. Hypersensitivity to biomaterials is often described in terms of vague pain, skin rashes, fatigue and malaise and in some cases implant loss. Recently, titanium hypersensitivity has been suggested as one of the factors responsible for implant failure. Although titanium hypersensitivity is a growing concern, epidemiological data on incidence of titanium-related allergic reactions are still lacking. Materials and methods: A computer search of electronic databases primarily MEDLINE and PUBMED was performed with the following key words: 'titanium hypersensitivity', 'titanium allergy', 'titanium release' without any language restriction. Manual searches of the bibliographies of all the retrieved articles were also performed. In addition, a complementary hand search was also conducted to identify recent articles and case reports. Results: Most of the literature comprised case reports and prospective in vivo/in vitro trials. One hundred and twenty-seven publications were selected for full text reading. The bulk of the literature originated from the orthopaedic discipline, reporting wear debris following knee/hip arthroplasties. The rest comprised osteosynthesis (plates/screws), oral implant/dental materials, dermatology/cardiac-pacemaker, pathology/cancer, biomaterials and general reports. Conclusion: This review of the literature indicates that titanium can induce hypersensitivity in susceptible patients and could play a critical role in implant failure. Furthermore, this review supports the need for long-term clinical and radiographic follow-up of all implant patients who are sensitive to metals. At present, we know little about titanium hypersensitivity, but it cannot be excluded as a reason for implant failure.

Hypersensitivity to titanium osteosynthesis with impaired fracture healing, eczema, and T-cell hyperresponsiveness in vitro: case report and review of the literature.

Thomas P, Bandl WD, Maier S, Summer B, Przybilla B.


Abstract

There are very few reports on hypersensitivity reactions in association with titanium-based materials so that the existence of allergy to titanium is still put in question. We report on a patient in whom impaired fracture healing and eczema localized to the perioperative area developed upon titanium-based osteosynthesis. Patch testing gave no reactions to titanium
nor to nickel, chromium, or cobalt. However, in the lymphocyte transformation test, the patient's lymphocytes showed markedly enhanced proliferation in vitro to titanium. After removal of the titanium material, fracture healing was achieved and the eczema cleared. Parallel to this, in vitro hyperreactivity to titanium disappeared. Although contact allergic reactions to titanium have been very rarely reported, these findings support a diagnosis of titanium allergy in our patient.

**Allergologische Diagnostik bei Verdacht auf Implantatunverträglichkeit: Hinweise für die Praxis**

*Eine Stellungnahme der Deutschen Kontaktallergie-Gruppe (DKG)*

Geier J, Lessmann H, Becker D, Thomas P

Hautarzt 2008 · 59:594–597

*Kein Abstract*

**Titanium allergy in dental implant patients: a clinical study on 1500 consecutive patients.**


Comment in:


**Abstract**

BACKGROUND: In dentistry, allergic reactions to Ti implants have not been studied, nor considered by professionals. Placing permanent metal dental implants in allergic patients can provoke type IV or I reactions. Several symptoms have been described, from skin rashes and implant failure, to non-specific immune suppression.

OBJECTIVE: Our objective was to evaluate the presence of titanium allergy by the anamnesis and examination of patients, together with the selective use of cutaneous and epicutaneous testing, in patients treated with or intending to receive dental implants of such material.

MATERIAL AND METHODS: Thirty-five subjects out of 1500 implant patients treated and/or examined (2002-2004) were selected for Ti allergy analysis. Sixteen presented allergic symptoms after implant placement or unexplained implant failures [allergy compatible response group (ACRG)], while 19 had a history of other allergies, or were heavily Ti exposed during implant surgeries or had explained implant failures [predisposing factors group (PFG)]. Thirty-five controls were randomly selected (CG) in the Allergy Centre. Cutaneous and epicutaneous tests were carried out.
RESULTS: Nine out of the 1500 patients displayed positive (+) reactions to Ti allergy tests (0.6%): eight in the ACRG (50%), one in the PFG (5.3%) (P=0.009) and zero in the control group. Five positives were unexplained implant failures (five out of eight).

CONCLUSIONS: Ti allergy can be detected in dental implant patients, even though its estimated prevalence is low (0.6%). A significantly higher risk of positive allergic reaction was found in patients showing post-op allergy compatible response (ACRG), in which cases allergy tests could be recommended.

Suspected association of an allergic reaction with titanium dental implants: a clinical report.

Egusa H, Ko N, Shimazu T, Yatani H.


Abstract

Recent reports have questioned whether metal sensitivity may occur after exposure to titanium. This clinical report demonstrates the emergence of facial eczema in association with a titanium dental implant placed for a mandibular overdenture supported by 2 implants. Complete remission was achieved by the removal of the titanium material. This clinical report raises the possibility that in rare circumstances, for some patients, the use of titanium dental implants may induce an allergic reaction.

Implantatallergien

Thomas P, Thomsen M.


Abstract

Tissue reaction involving an intraoral skin graft and CP titanium abutments: a clinical report.

Mitchell DL, Synnott SA, VanDercreek JA.


Abstract

Focal areas of gingival hyperplasia surrounding the transmucosal portions of titanium implants have been attributed to poor hygiene, lack of attached gingival tissues, and titanium allergy. Following mandibular vestibuloplasty and placement of a split-thickness skin graft, two of five patients developed persistent proliferation of the epithelial tissue surrounding endosseous CP titanium dental implants. In both circumstances, traditional gingivectomy procedures, chemotherapeutic agents, and aggressive oral hygiene measures failed to adequately control the hyperplastic response. Following replacement of the titanium abutments with custom-fabricated gold abutments, the epithelial condition appeared to return to normal.

Biologische Eigenschaften dentaler Titanimplantate

Kniha H, Gahlert M

SpringerMedizin CME-Fortbildung. 2010 (11)

🔗 Artikel im Internetauftritt der Praxis Dres. Kniha und Gahlert unter Rubrik Presse / Videos frei einsehbar

Host response to titanium dental implant placement evaluated in a human oral model.

Flatebø RS, Johannessen AC, Grønningsaeter AG, Bøe OE, Gjerdet NR, Grung B, Leknes KN.


Abstract

BACKGROUND:

Recent reports have questioned if metal sensitivity may arise from exposure to titanium. The objective of this study was to histologically evaluate non-perforated mucosa covering submerged maxillary titanium implants with regard to induced tissue reactions.

METHODS:
Thirteen patients, 21 to 69 years of age, without previous implants were included. After initial examination, the bone crest areas destined for dental implant placement were exposed, and threaded external hex dental implants were inserted. Prior to wound closure, a full mucosal tissue slice was biopsied from the edge of the mucoperiosteal flap (baseline). The patients were monitored monthly for 6 months. At the abutment connection, biopsies were taken by a 6-mm punch, altogether yielding 26 specimens. Tissue reactions were analyzed by coded histometric analysis at four defined areas at increasing distance from the oral epithelium, including ratios of inflammatory cells (IC)/epithelial cells, IC/fibroblasts, and number of dense particles.

RESULTS:

The stained sections portrayed gingival tissue with intact oral epithelium and connective tissue with variable accumulation of IC. Experimental biopsies demonstrated mineralized areas and dense particles of different sizes. Analysis of variance revealed a higher IC/fibroblast ratio for level 3 at baseline compared to level 3 at 6 months (P<0.01). Furthermore, a significant decrease in IC/fibroblast ratio was observed between levels 2 and 3 and 2 and 4 at 6 months (P<0.001). The connective tissue level facing the cover screw contained the highest number of dense particles (P<0.01).

CONCLUSIONS:

Tissue sensitivity reactions to titanium implants were not disclosed. All 6-month biopsies contained dense particles that were most likely metals.

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**Evaluation of the biocompatibility of titanium-tantalum alloy versus titanium.**


Prigent H, Pellen-Mussi P, Cathelineau G, Bonnaure-Mallet M.

**Abstract**

To evaluate the biocompatibility of a new titanium-tantalum alloy, with qualities superior to titanium alone, for use in oral implantology, fibroblast and epithelial cell lines were grown on plastic, titanium, copper, and titanium-tantalum supports. Studies using scanning electron microscopy, flow cytometry, and cytotoxicity assays were conducted to compare the different supports. Scanning electron microscopic observations showed high densities of fibroblasts and epithelial cells with well-developed attachment systems in the form of cytoplasmic projections. Cell densities were lower on titanium and titanium-tantalum surfaces than on plastic. Cell numbers, as determined by cytotoxicity assays, were significantly higher on plastic than on titanium or titanium-tantalum surfaces while fibroblasts proliferated better than epithelial cells on both metal surfaces. Flow cytometric analyses of cell cycles did not reveal any significant variations in the distribution of cells among the cycle phases on the three materials. We found no differences with regard to the parameters studied between titanium and the titanium-tantalum alloy.
**Materials characteristics of uncoated/ceramic-coated implant materials.**

Lacefield WR.


**Abstract**

In this paper, the biocompatibility of dental implant materials is discussed in the context of both the mechanical characteristics of the materials and the type of surface presented to the surrounding tissues. The proper functioning of the implant depends on whether it possesses the strength necessary to withstand loading within the expected range, with other properties such as elongation being of importance in some instances. A suitable modulus of elasticity may be of major importance in situations when optimum load transmission from the implant into the surrounding bone is key to the successful functioning of the device. Dental implants present a wide range of surfaces to the surrounding tissues based on surface composition, texture, charge energy, and cleanliness (sterility). Metallic implants are characterized by protective oxide layers, but ion release is still common with these materials, and is a function of passivation state, composition, and corrosion potential. An effective surface treatment for titanium appears to be passivation or anodization in a suitable solution prior to implantation. Inert ceramic surfaces exhibit minimal ion release, but are similar to metals in that they do not form a high energy bond to the surrounding bone. Some of the newly developed dental implant alloys such as titanium alloys, which contain zirconium and niobium, and high-strength ceramics such as zirconia may offer some advantages (such as lower modulus of elasticity) over the conventional materials. Calcium phosphate ceramic coatings are commonly used to convert metallic surfaces into a more bioactive state and typically cause faster bone apposition. There is a wide range of ceramic coatings containing calcium and phosphorus, with the primary difference in many of these materials being in the rate of ion release. Although their long-term success rate is unknown, the calcium phosphate surfaces seem to have a higher potential for attachment of osteoinductive agents than do uncoated titanium and other more inert implant materials.

⇒ Artikel frei einsehbar unter:

⇒ http://adr.sagepub.com/content/13/1/21.long

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

Chaturvedi TP.


**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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Materials for endosseous dental implants.

Wataha JC.


Abstract

The goal of placement of endosseous dental implants is to achieve osseointegration or biointegration of the bone with the implant. A wide variety of materials has been used for these implants, but only a few promote osseointegration and biointegration. Titanium and titanium alloy (Ti6Al4V) have been the most widely used of these materials. The surface oxide of titanium appears to be central to the ability of this material to osseointegrate. The oxide limits dissolution of elements and promotes the deposition of biological molecules which allow bone to exist as close as 30 Å to the surface of the implant. The details of the ultrastructure of the gap between the implant and bone remain undefined, and the consequences of elements which are released on the interface over time are not known. These areas of investigation are particularly important in defining the differences between commercially pure titanium implants and those made of titanium, aluminium and vanadium. The epithelial interface between the gingiva and titanium appears to contain many of the structural characteristics of the native tooth-gingiva interface, but details are still vague. The connective tissue interface with the titanium appears to be one of tightly fitting tissues rather than adhesion. Ceramic coatings appear to improve the ingrowth of bone and promote chemical integration of the implant with the bone. The characteristics of these coatings are complex and affect the bony response, but the mechanisms remain obscure. The degradation of the coatings is an issue of particular controversy. Progress in dental implantology is likely to continue as the interface between the material and bone is more clearly understood, and biological molecules and artificial tissues are developed.