

Nanocrystalline diamond coated dental implants

Next generation of dental implants and abutments

- Nanocrystalline diamond coatings possess extraordinary properties:
 - Nano-structures increase reactive surface area for better cell-interaction, osseointegration or soft tissue attachment
 - Chemical inertness, good biocompatibility
 - High corrosion resistance
 - Entire passivation of metal substrate & diffusion
- Customized implant surface (hydrophilic (OH-groups), functionalization, surface roughness)
- Industrial production of quality controlled NCD-coating as medical device
- First in-patient trial ongoing

Summary

Common obstacles in the field of dental implantology are primary stability, long-term biocompatibility and endurance, healing and remodeling within bone of elderly patients, impaired soft tissue integration and osseointegration leading to periimplantitis. Due to the aging of the society, the prevalence of osteoporosis has increased. Furthermore the incidence of medical therapies such as radiotherapy, chemotherapy, impairs the quality of bone. NCD-coated implants aim to solve these obstacles and DiaCoating is convinced that tailored NCD surfaces may rapidly find its way into common clinical use.

Features

- Multi component system with tunable properties – according to patients' requirements

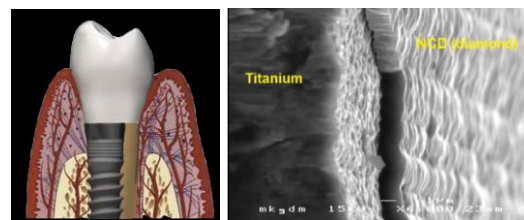
- Controllable surface properties
- Improved osseointegration and cell adhesion
- Corrosion resistance

Advantages

- Improved cell adhesion and implant integration due to increase of surface by tunable nano structures
- Good biocompatibility based on a strong passivation
- Improved hydrophilicity combined with high stability & hardness
- Flexible, stable and efficient technique for immobilization of biomolecules like growth factors (low & controlled release in order to minimize systemic effects)
- Long-term stability – no follow-on surgery

Applications

- NCD-coating of *dental implants* to improve osseointegration and tight soft tissue attachment, restoring the skin/mucosa function as a barrier in the peri-implant zone

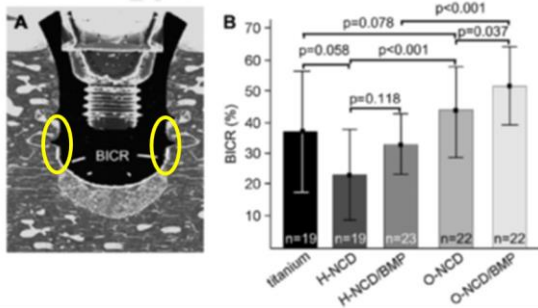


NCD-coating on titanium surface providing increased hydrophilic surface area.

Results of in vivo tests

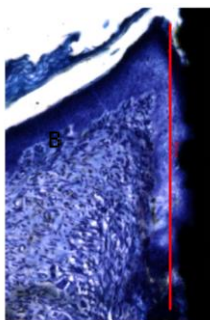
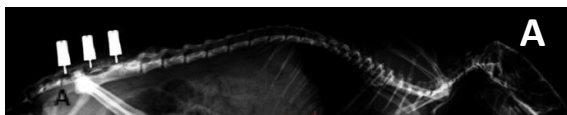
Up to now DiaCoating has carried out many *in vivo* studies and demonstrated the excellent performance and advantage of the NCD-coating in comparison to SLA titanium surfaces:

Osseointegration:

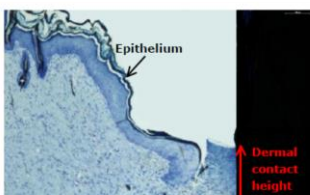
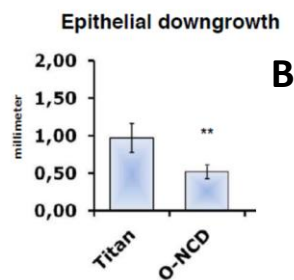


Bone-implant-contact-ratio (BICR) was determined at the apical surface of the implant opposing the area of regeneration as shown in the diagram at the lower left site of the panel (A, yellow marked) and for those specimens that were derived from experimental animals, 4 weeks after implant insertion (B).

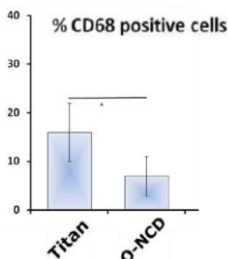
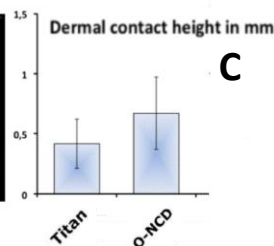
Soft tissue attachment:



Giemsa Staining



Titanium stained with Giemsa



NCD coated percutaneous implants inserted in A: athymic nude rat in lumbo-sacral area of the spine showing B: lower epithelial downgrowth, C: higher dermal contact height and D: lower inflammation.

First in-patient trial in collaboration with Otto Bock Healthcare Products is ongoing, the results of testing percutaneous implants with respect to soft tissue attachment, dermal contact height and downgrowth will be available mid of 2014.

Some of the most important results are published:

Osseointegration:

- Kloss et al., Biomaterials 2008, 29: 2433-2442
- Kloss et al., Head and Neck J Sci Spec, 2013, 35 (2): 235-241

Soft tissue attachment:

- Kloss et al., Diamond Related Materials 2008;17:1089-1099
- Kloss et al., Clin Oral Implants Res. 2011 Jul; 22 (7): 699-70

Business model:

The technology and application of NCD on implants is patented by DiaCoating. We want to out license the technology to a strategic partner in the field of dental implantology. We offer the NCD coatings for our partner or provide him with the deposition technology/equipment to produce the coating under his own control.

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