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Titanium Nitride Coated Implant Abutments: From Technical Aspects And Soft tissue Biocompatibility to Clinical Applications. A Literature Review

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Abstract

Purpose: To review the most up to date scientific evidence concerning the technical implications, soft tissue biocompatibility, and clinical applications derived from the use of titanium nitride hard thin film coatings on titanium alloy implant abutments.

Materials and methods: A review was performed to answer the following focused question: "What is the clinical reliability of nitride coated titanium alloy abutments?". A MEDLINE search between 1980 and 2021 was performed for investigations pertaining to the clinical use of nitride coated titanium alloy implant abutments (TiN) in case reports, case series, and short- and long-term non/randomized controlled clinical trials. Literature analysis led to addition evaluation of research related to the technical and biological aspects, as well as the physicochemical characteristics of TiN hard thin film coatings and their impact on titanium abutment biocompatibility, mechanical properties, macroscopic surface topography, and optical properties. Therefore, preclinical data from biomechanical and in vitro investigations were also considered as inclusion criteria.

Results: The limited number of clinical investigations published made a systematic review and meta-analysis not possible, therefore a narrative review was conducted. TiN coatings have been applied to dental materials and instruments to improve their clinical longevity. Implant abutments are coated with titanium nitride to mask the titanium oxide surface and enhance its surface characteristics providing the TiN abutment surface with a low friction coefficient and a very high chemical inertness. TiN coating is suggested to reduce early bacterial colonization and biofilm formation and enhance fibroblast cell proliferation, attachment and adhesion when compared to Ti controls. Additionally, studies indicate that hard thin film coatings enhance the mechanical properties (hardness and wear resistance) of titanium alloy and appears as a yellow color when deposited on the titanium alloy substrate. To date, clinical investigations show that nitride coated titanium abutments provide promising short-term clinical outcomes.

Conclusions: Published research on nitride-coated abutments is still limited, however, the available biomedical research, mechanical engineering tests, in vitro investigations, and short-term clinical trials have, to date, reported promising mechanical, biological, and esthetic outcomes.

Keywords: CAD-CAM; dental implants; hard coatings; implant esthetics, titanium nitride.

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