Influence of Non-Irrigation During Implant Insertion on All-Over Success: An Eighteen Months Follow-up of 1001 FRIADENT® plus Screws

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Objective

The achievement of osseointegration may be affected by variables such as implant macro- and microdesign. It has been claimed that implants with micro roughened surfaces may promote the rate and degree of osseointegration and eventually improve the clinical success rate. Several authors have investigated the factors related to properties, such as surface micro roughness, chemistry, wettability, and surface topography. Recently, a new, enhanced implant surface has been introduced to the market, (FRIADENT® plus surface, DENTSPLY Friadent, Mannheim/Germany) obtained by a new grit-blasting and acid-etching technique. The surface is grit-blasted with large grit aluminium oxide particles (350-500 µm) and acid-etched at high temperature via computer-controlled processes. It displays a regular micro roughness with pores in the micrometer range overlaying a macro roughness structure caused by grit-blasting. With this surface, high bone-to-implant contact percentages (BIC) have been previously determined by the authors for immediately loaded and submerged implants in humans. In an in vitro study using the novel surface, a correlation between surface morphology and fibrin clot extension has been demonstrated. Increasing the complexity of the surface micro texture seems to determine the formation of a more extensive and three-dimensionally complex fibrin scaffold. It is known that surface wettability influences protein adhesion and therefore likely, that this influences the rate of cell attachment and cell spreading. Changes in surface wettability properties during cell spreading could interfere with filopodial attachments and might explain the multifocal attachments and extended appearance of osteoblasts on the FRIADENT® plus surface. Wettability tests showed that the FRIADENT® plus surface is initially hydrophobic (contact angle 140.94°) but on second contact with water this changes to an extremely hydrophilic behavior. This unique wettability characteristic has been hypothesized to lead to an advanced adhesion of non-collagenous proteins like sialoprotein and osteopontin, which are the preconditions of contact osteogenesis. In conjunction with the clinical use of the new micro structured FRIADENT® plus implants, controversies on the necessity of internal and external irrigation during implant insertion have emerged. The impact of various parameters on bone heating during drilling and tapping procedures used in site preparation for dental implants have been studied extensively. The surgery sequences and, particularly bone drilling, may lead to bone necrosis, if physiology is not respected. The temperature of denaturation of the alkaline phosphatases (56°C) should not be passed. After healing, uncontrolled thermal injury can result in a fibrous tissue, interpositioned at the implant-bone interface, putting into question the long term prognosis. In-vitro studies in bone growth chambers have demonstrated that it was possible to obtain functional bone regeneration, if a temperature of 44°C is not exceeded. Consequently, the use of internal and external irrigation drilling systems have been recommended. One aspect that has received little emphasis in the literature is the effect of saline irrigation on bone temperature reduction during the placement of implant screws. The use of irrigation during implant-screw insertion has been promoted on the hypothesis of coolant delivery to the implant interface, which should subsequently improve local debridement and cooling, and therefore reduce thermal insults to the bone. However, documented long-term data on the basic necessity of irrigation during implant placement are still missing. A potential conflict of surface wettability and the use of coolant agents were neglected. The aim of the present investigation was to examine whether coolant delivery during implant screw insertion is an absolute prerequisite to secure osseointegration, or just an adopted measure based on theoretical assumptions. The poster will evaluate the influence of non-irrigation during implant insertion on the long-term clinical outcome of grit-blasted and high-temperature acid-etched FRIADENT® plus implants.

Material and Methods

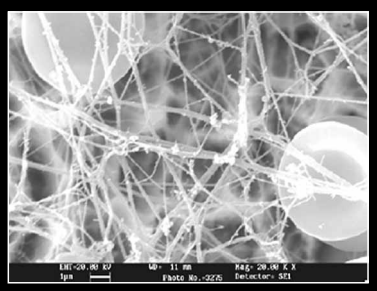
A total of 1001 FRIADENT® plus implant screws were placed in the period between July 2003 and September 2004; of which 318 (31.8%) in men and 683 (68.2%) in women. All implants were placed without the application of coolant delivery by internal or external irrigation. Immediate loading was chosen for 527 (52.7%) implants and delayed loading for 474 (47.3%) implants. In this case a submerged technique (two-stage) or single-stage procedure was used. The following variables were analyzed: implant length (minimum length 8.0 mm), implant diameter (minimum diameter 3.0 mm), implant type (FRIALIT® plus, XiVE® plus), receptor site, type of loading (immediate or delayed) and bone quality (DI-DIV). Implant success rates were evaluated according to the following criteria: (1) absence of persisting pain or dysesthesia; (2) absence of peri-implant infection with suppuration; (3) absence of mobility; and (4) absence of peri-implant bone resorption.

Results

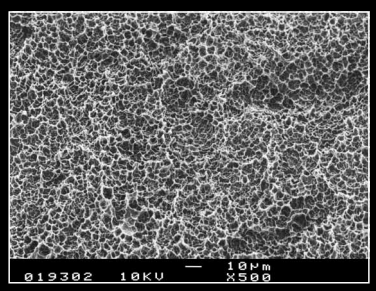
728 XiVE® plus implants (72.7%), 204 FRIALIT® plus implants (20.4%), and 69 XiVE® TG plus implants (Transgingival) (6.9%). Implant diameters were distributed in the following manner: 155 (15.5%) of 3.0 mm, 152 (15.2%) of 3.4 mm, 323 (32.4%) of 3.8 mm, 246 (24.6%) of 4.5 mm, 123 (12.3%) of 5.5 mm, and 2 (0.2%) of 6.5 mm. Implant lengths were placed as follows: 50 (5%) of 8.0 mm, 46 (4.6%) of 9.5 mm, 42 (4.2 %) of 10 mm, 261 (26.1%) of 11 mm, 237 (23.6%) of 13 mm, 360 (35.9%) of 15 mm, and 5 (0.5%) of 18 mm. 99 implants (9.9%) replaced cuspids, 175 implants (17.5%) replaced incisors and 727 implants (72.7%) replaced premolars and molars. Only three of 1001 implants failed to integrate. An implant success rate of 99.6% was achieved for a period of eighteen months after prosthetic loading. Four implants had a crestal peri-implant bone resorption higher than 1.5 mm during the first year. The mean crestal bone loss was 0.15 mm (ranging from +0.9 to -2.0).

Conclusion

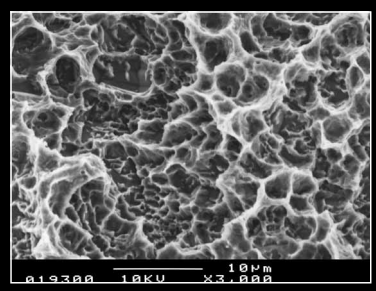
High success rates can be achieved if an implant system with a suitable macrodesign, thread geometry and dually enhanced, grit-blasted and acid-etched surface morphology is selected. Within the limits of the present study, the preliminary data indicate that the absence of coolant delivery to the implant interface of FRIADENT® plus implant screws during insertion, will not lead to uncontrolled thermal bone injuries. In this context, it can no longer be assumed that coolant delivery during implant placement is imperative for osseointegration.



Fibrin scaffold on FRIADENT® plus (SEM 1000 x)

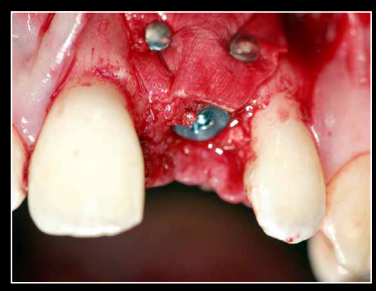


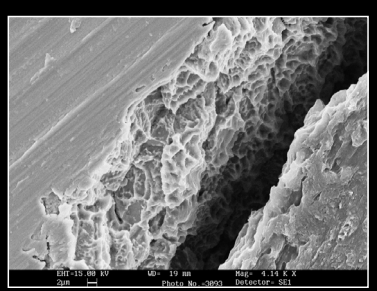
FRIADENT® plus surface (SEM 500 x)

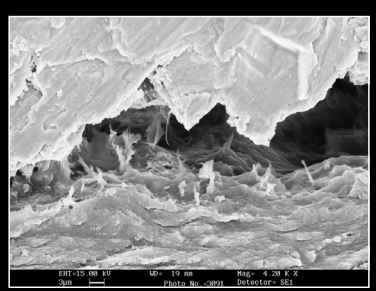


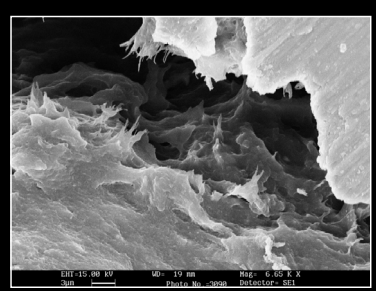
FRIADENT® plus surface (SEM 3000 x)


Trauma case: peri-apical x-ray before and after implant placement and augmentation


Surgical view of membrane and tacks


Bone ingrowth on FRIADENT® plus surface (SEM x4.14 K)

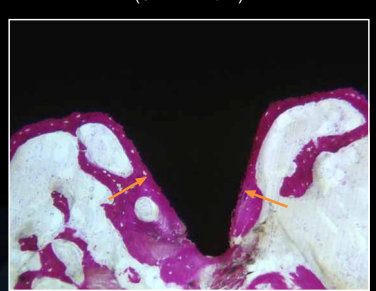

Bone ingrowth on FRIADENT® plus surface (SEM x4.20 K)

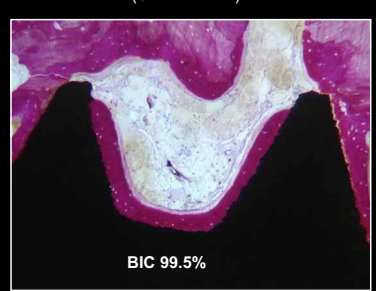

Bone ingrowth on FRIADENT® plus surface (SEM x4.14 K)


Tissue healing 8 months post op


Transfer coping and cap for impression taking


Histology of XiVE® plus implants

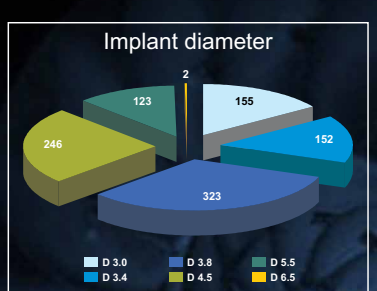

Histology
Note: new boneline with contact osteogenesis



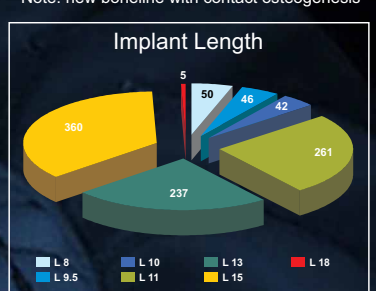
BIC 99.5% in bone densities DI/DII after 10 weeks


Acrylic provisional crown in situ.
Soft tissue 2 months post stage II

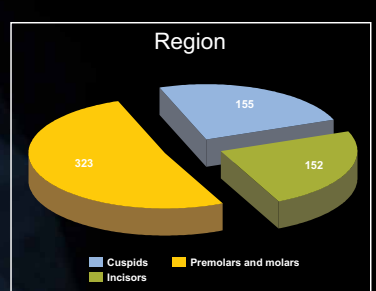

Seating of CERCON® abutment



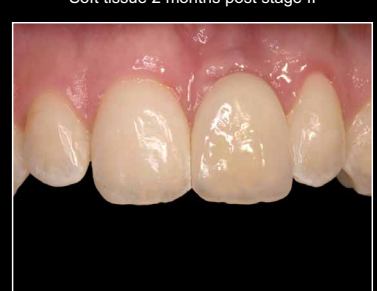
Implant diameters



Implant lengths



Implant region


Close-up of full ceramic restoration


Final restoration cemented in situ

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