International Poster Journal IPJ of Dentistry and Oral Medicine

Int Poster J Dent Oral Med 2002, Vol 4 No 04, Poster 146

Stepped, Root-Analog Wide Diameter Implants: A New Approach to Surpass Conventional Implant Therapy

Language: English

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Date/Event/Venue:
April 15-17, 1999
8th International Congress on Reconstructive and Preprosthetic Surgery
San Diego, USA

Summary

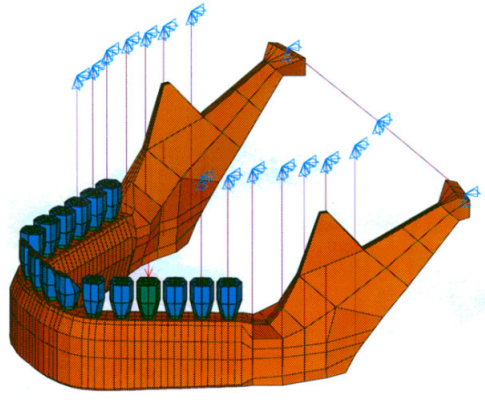
When osseointegrated implants were first introduced, they were only recommended for the restoration of moderately or severely atrophied edentulous jaws. Disregarding anatomical structures, standard cylinder implants were used, varying in length only. This compromise often caused fracture of prosthetic components, incessant screw loosening and eventually failure of the implant. Today's efforts towards attaining esthetic and functional long-term success of implant-supported prostheses focus not only on prosthetic aspects, but also on preservation or reconstruction of skeletal and soft tissue structures. According to anatomical studies, root-analog implants corresponding in shape, diameter and length to the root geometry of the natural dentition are consistent with the anatomy of the maxilla and mandible. The earliest possible placement of an anatomically shaped implant prevents the atrophy of the alveolar process and maintains gingival height for better soft tissue esthetics.

An anatomic implant diameter is important for:

- Functional load distribution
- Prosthetic and biomechanical stability
- Higher degree of implant-to-bone contact
- Correct soft tissue adaptation
- Reconstruction of an anatomic emergence profile

When small diameter implants are used due to narrow ridge dimension, the finished restoration will be significantly larger than the implant. To achieve normal restorative dimensions the crown must be ridge-lapped which results in limited hygiene possibilities and stress on the implant and abutment screw. Whenever it is possible to match implant diameter to the size of the replaced tooth, a smoother and more natural emergence profile results.
The availability of an implant diameter according to root diameter, and the earliest possible implant placement post-extraction are important parameters for a successful esthetic and functional result. Clinical cases will underline the benefits of root-analog wide diameter implants such as: increased prosthetic and biomechanical stability, reduced screw stress, higher degree of implant-to-bone contact, taking full advantage of remaining bone under the maxillary sinus in order that surgical procedures can be reduced, improved emergence profile and avoidance of ridge-lap designs.

Material and method

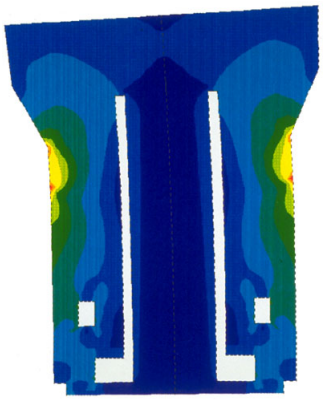


Investigation of the biomechanical parameters utilizing the Finite-Element-Program Ansys 5.0 for two and three dimensional simulations.
A model of the jaws with about 8000 elements and 27.000 knots with simulation of the muscle retention.

Elastic module (N/mm^2)	
Cortical bone	6.000
Spongy bone	800
Titanium	100.000
Crown and brigde work	200.000

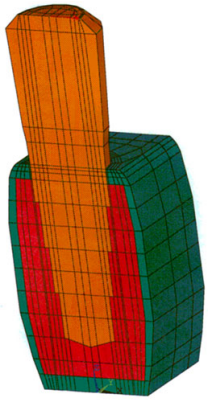
Functional load distribution

Influence of implant diameter on load distribution at implant-abutment connection

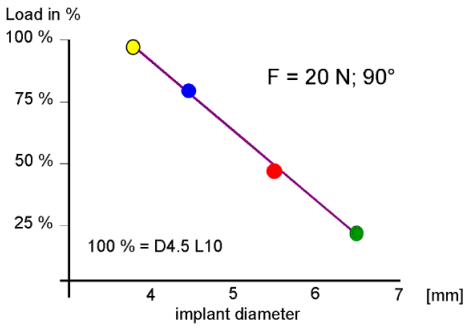


2D-FEM-analysis of micromechanic interface of implant-abutment connection

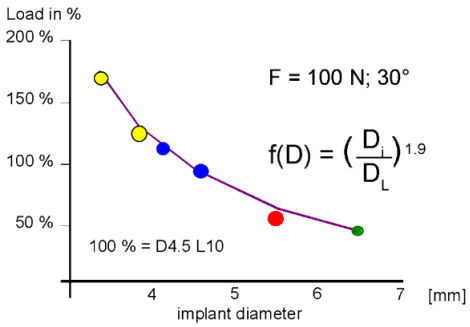
Influence of implant diameter on load distribution at peri-implant bone interface



3D-FEM analysis to investigate the load distribution in the peri-implant bone

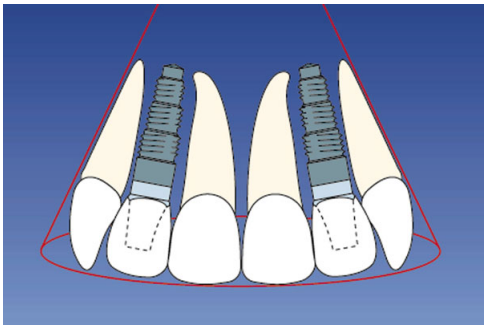


The load on top of the implant is reduced by 83% for a D 6.5 Implant in comparison to D 3.8 with equal occlusal load



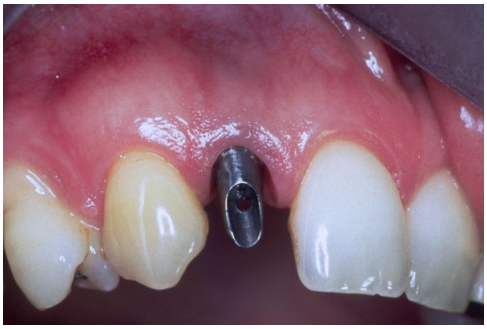
The load of the peri-implant bone is reduced by 60% for a D 6.5 Implant in comparision to a D 3.8 by equal occlusal load

Reconstruction of an anatomic emergence profile



Achieving an individual wide platform in the anterior by selection of a stepped cylinder implant

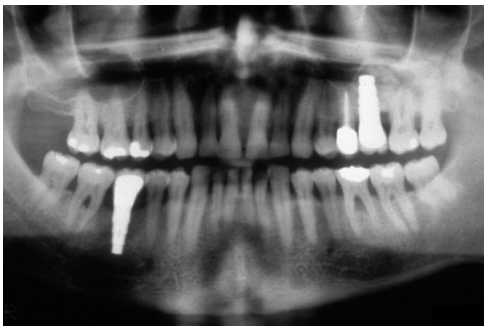
Optimal load distribution due to stable internal abutment connection



Various prosthetic options on customized abutments allow an individual prosthetic procedure

Easy hygiene due to natural emergence profile by root-analog implant selection with diameter 6.5 mm

Complete restoration of soft tissue for a natural crown profile



Radiograph after 2 years of prosthetic loading: Perfect osseointegration even with single posterior crowns

Discussion

The availability of tooth analog implant diameters for the reconstruction of molars, premolars, canines, lateral and central incisors expands treatment options and enhances the therapeutic outcome. An ideal implant placement according to anatomic considerations is achievable because of the flared root-analog stepped implant design, without risk of damage of adjacent anatomical structures. The wide prosthetic platform of root-analog implants provides a natural emergence- and submergence profile. The longterm stabilty of the soft tissue guarantees a healthy and functional treatment outcome.
An internal implant-abutment connection with a long guidance depth and strong anti-rotation device secures the passive fit of the abutment especially under horizontal load. The passive retention of the abutment reduces the tensile forces on the fastening screws. Prosthetic complications like screw loosening and abutement fractures are prevented in high load areas of the posterior region of the mandible and maxilla.

Literature

- Richter, E.-J.: Die Verbundbrücke zwischen Zahn und Implantat: Ergebnisse experimenteller und klinischer Untersuchungen Habilitationsschrift, Aachen, 1992
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This Poster was submitted by Dr. Dr. Dieter Haessler.

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Poster Faksimile:

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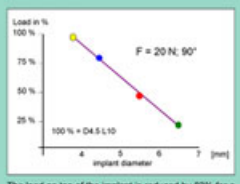

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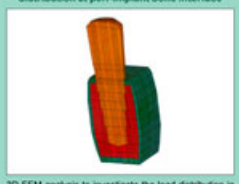

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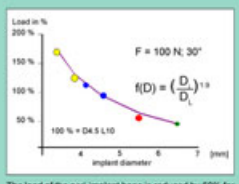

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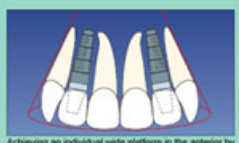

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