A study into the feasibility of obtaining the ideal implant design: Results based on scientific studies and their implementation through to prototype manufacturing (September 2003 – April 2008). (S)

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Introduction / Problem

Objective: Implant design and construction has never been based only on scientific studies but rather refined according to experience or hypothetical approaches.

Methods and procedures

The author conducted studies of scientific literature to provide a comparison and evaluation of key implant properties. This analysis resulted in a scientifically based model of the “perfect” implant, similar to a modular system.

The following criteria were used to evaluate implant properties:

- Choice of materials with regard to osseointegration
- Design and/or functional aspects with regard to osseointegration
- Choice of materials with regard to gingival integration
- Design with regard to gingival integration
- Short- and long-term periodontal aspects with regard to
  a) stability b) bacterial contamination c) biological width
- Surface treatment according to the functional requirements of tissue portions
  a) gingival attachment b) osseointegration

Result of scientific studies

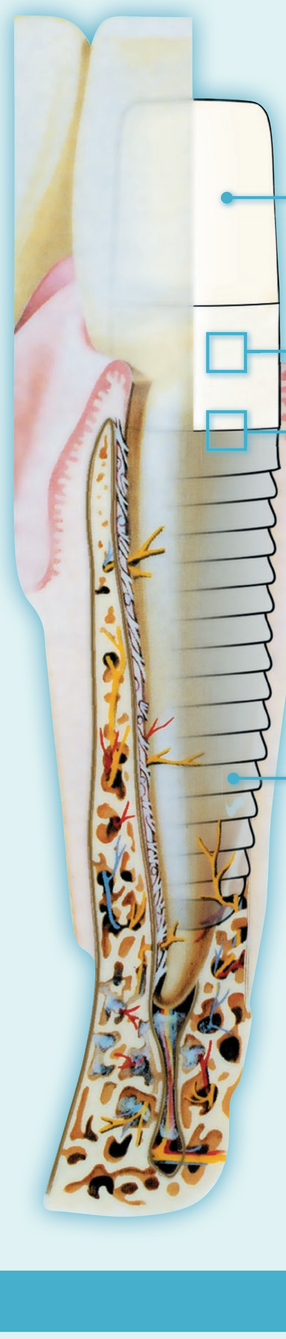
Implementation of theoretical planning processes into real construction and prototype manufacturing.

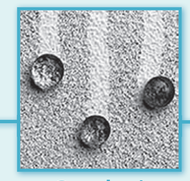
Result of scientific studies.

The One Piece Ceramic-Titanium Implant. (patent.)

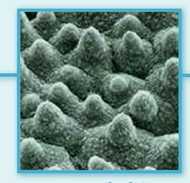
The biological, aesthetic implant that follows the model of nature.

Graphic representation

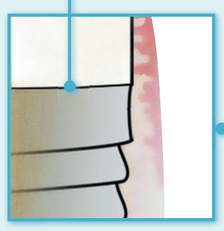




Graph a)



Graph b)



1 The Ceramic-Abutment:

- **Aesthetics in soft tissue**
  No display of the dark titanium through the gingiva.
- **Soft-tissue barrier**
  Superior gingival integration.
  Connective tissue attachment.
- **Preservation of biological width and aesthetics**
  due to the individual preparation of the ceramic in harmony with the shape of the gingiva.
- **No heat generation**
  and no necrosis of bone during the preparation.

2 The Lotus-Effect of the Abutment: (patent.)

Graph a) - No adhesion of plaque and microorganisms as in the natural tooth.

Graph b) - Self-Cleansing biologic surface due to a special combination of micro- and nano-structure.

3 The Connection: (patent.)

- **Long-term connection free of microorganisms**
  Stable connection of the ceramic to the underlying titanium when exposed to the oral cavity due to isostatic pressing technique.
- **No micro-gap-effect:**
  No horizontal and vertical bone-loss caused by microorganisms as found in the micro-gap of conventional two-piece systems.

4 The Titanium-Screw:

- **solid with long term proven stability**
- **surface for a safe osseointegration**
- **conical shape as the natural tooth**
- **absolute symmetry of rotation**
  insert with optimal insertion torque for superior primary stability and immediate function

Original photo prototyp

Studies and sources

Study 1

Soft-tissue reaction

- "Ceramic abutments show healthy and stable gingiva and proved to be superior to other materials".
  Andersson B, Taylor A, Lang BR, et al; Int J Prosthodont. 2001 Sep-Oct.
- "Fibroblasts show superior connection to rough ceramic surfaces leading to connective tissue attachment".
  Mustafa K, Oden A, Wennerberg A, et al; Biomaterials. 2005 Feb.
- "Attachment complex of gingiva and abutments made of aluminium-oxid ceramic is similar to that to the tooth.
  Exhibits a basal lamina and hemidesmosomal layer".
  McKinney RV Jr, Steflik DE, Koth DL; J Periodontol. 1985 Oct.
- "Plaque adhesion to ceramic abutments is significantly less than to titanium abutments".
  Barclay CW, Last KS, Williams R; Int J Prosthodont. 1996 Sep-Oct.
- "Positive tissue reaction to zirconium-oxide ceramic".
  Glauser R, Sailer I, Wohlwend A, et al; Int J Prosthodont. 2004 May-Jun.

Study 2

The natural model

- "The phenomenon of self cleansing has been scrutinized and offers possibilities of protection against plaque and microorganisms. Applying the characteristics of the lotus effect on implant surfaces creates a self-cleansing phenomenon".
  Furstner R, Barthlott W, Neinhuis C, et al; Langmuir. 2005 Feb.

Study 3

- "Two-piece implants show significant potential for inflammation and bone resorption at the micro gap. One-piece implants showed none".
  Broggini N, McManus LM, Hermann JS, et al; J Dent Res. 2003 Mar.
- "One-piece implant show the least bone resorption when the surface is roughened. Surface roughness is carried to the margin of the crown, respecting the biological width".
  Hartman GA, Cochran DL; J Periodontol. 2004 Apr.
- "With the two-piece system, it is impossible to keep the micro-gap free of bacteria. This leads to an inflammation of the marginal mucosa".
  Guindy JS, Besimo CE, Besimo R, et al; J Oral Rehabil. 1998 Jun.
- "Sealing Materials to fill up the inside of an implant e.g. wax offer best nutrition for bacteria in the micro gap"
  Xin Xie; Universität Köln. 2004 Mai.
- "Positive gingival aesthetics is based on a constant and healthy biological width. The gingiva around the one piece implant is similar to the gingiva condition of natural teeth. Two piece systems show inferior biological results".
  Hermann JS, Buser D, Schenk RK, et al; Clin Oral Implants Res. 2001 Dec.

Study 4

- "The optimal primary stability of an implant screw in the human bone without fracture is achieved at 70 Ncm insertion torque within bicortical bone and 50 Ncm within unicortical bone".
  Ueda M, Matsuki M, Jacobsson M, et al; Int J Oral Maxillofac Implants. 1991 Winter.
- "A moderate implant loading with provisional restorations improves the perioimplant bone quality".
  Nentwig G H, Psenicka H; Göttingen. 2003 Nov.

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