COLLECTION OF ABSTRACTS FROM PUBLISHED ARTICLES RELATED TO THE ENDOPORE® DENTAL IMPLANT SYSTEM

1. Observations on the Effect of Movement on Bone Ingrowth into Porous-Surfaced Implants

R.M. Pilliar, J.M. Lee, and C. Maniatopoulos

Although porous-surfaced orthopedic implants have been designed for fixation by bone ingrowth, there is clinical evidence that this does not always occur. Initial implant movement relative to host bone can result in attachment by a non-mineralized fibrous connective tissue layer. The ranges of movement that result in either bone or fibrous connective tissue fixation are observed in dogs in two independent studies. Experimentally, bone ingrowth can occur in the presence of some movement, albeit very small (up to 28 µ), while excess movement (150 µ or more) can result in attachment by mature connective tissue ingrowth.

Clin Orthop Rel Res 1986; 208:108-113

2. A Histological Assessment of The Initial Healing Response Adjacent to Porous-Surfaced Titanium Alloy Dental Implants In Dogs


We report here the results of a histological assessment of the initial healing response following implantation into the dog mandible of a porous-surfaced, titanium alloy endosseous dental implant. Two implants were placed in edentulous areas on each side of the mandible of each dog and covered with a full-thickness mucoperiosteal flap. The implant sites on one side of the mandible were allowed to heal for four weeks, while those on the other side were allowed to heal for eight weeks before the animals were killed. Histological specimens were obtained and assessed both qualitatively and by computer-assisted morphometry. All but one of the 24 implants were well tolerated and healed with a variable ingrowth of bone into the porous-surface geometry. The histomorphometric measurements revealed that bone ingrowth had reached a plateau by four weeks of initial healing.

J Dent Res 1986; 65:1064-1070 - @
3. Threaded Versus Porous-Surfaced Designs For Implant Stabilization In Bone-Endodontic Implant Model

C. Maniatopoulos, R.M. Pilliar, and D.C. Smith

An endodontic implant model system was used to compare the effect of implant design on stabilization in bone. Specifically a porous-surfaced design was compared to conventional threaded and smooth-tapered endodontic implant designs. All implants were placed in immediate function thereby assessing the effect of early limited movement on the fixation achieved. A total of eighty-three endodontic implants were inserted in the mandibles of six adult mongrel dogs. Animals were sacrificed immediately after implantation and after 3, 6, and 12 months. Implants were evaluated by clinical and radiographic examination and after animal sacrifice by pull-out tests of the implant from the tissues, SEM examination of the pulled-out implants and, finally, histology. The pull-out test results indicated increasing shear strength with implantation time for the porous-surfaced implants in contrast to the gradual loss of fixation for the threaded implants and the continuous low shear strength for the smooth implants. Histological studies and SEM examination indicated the reason for these changes. Smooth implants became encapsulated by fibrous connective tissue from early post-implantation time periods. Threaded implants, although initially mechanically interlocked with bone, developed a fibrous connective tissue capsule that gradually thickened and this was assumed to be due to implant movement. The porous-surfaced implants, however, became stabilized by bone ingrowth and showed more extensive bone formation within the surface pores with time. It is concluded that for implants that are made functional immediately after implantation, as in this study, porous-surfaced implants can become strongly fixed by bone ingrowth, in contrast to conventional threaded or smooth-surfaced designs, thus presenting a more favorable long term prognosis.


4. Implant Stabilization by Tissue Ingrowth

R.M. Pilliar

The use of porous-surfaced implants capable of fixation through tissue ingrowth represents a possible method for the long-term stabilization of load-bearing implants. This approach has been used clinically with success for stabilizing orthopaedic implants in bone and the use of porous-surfaced implants is presently being investigated in dentistry. Experience in orthopaedics has been more extensive and some necessary, but not necessarily sufficient, conditions for bone ingrowth have been indicated. These include, in addition to the normal requirements for any implant, an initial maximum allowable movement of the implant relative to the host bone and a minimum pore size. Although bone ingrowth has been observed within pores as small as 30 microns, for practical purposes a pore size greater than about 100 microns is recommended for extensive bone ingrowth and strong interface fixation to occur. The effect of pore size on bone ingrowth is of great practical significance in view of the requirement of initially limited relative movement between the implant and bone. In practice, this can be achieved by restricting the loading or function of the implant for an initial period after placement. To make this period as short as possible, a rapid rate of bone ingrowth is desirable. It should be noted that this
requirement is common to other implant designs, which achieve long-term implant fixation by bone remodeling (even those which rely on acrylic bone cements). Metals, polymers and ceramics in the form of powders, fibres and wire mesh have been used for fabricating porous-surfaced implants. Examination of the resulting surface structures has indicated one area of concern with the use of these systems: their much greater surface areas. The consequences of the greater reactivity and possibly higher levels of trace elements released from these implants require further study. Improved fixation will result in a distinctive tissue structure at the interface (much thinner fibrous encapsulating layers, for example) and this will also influence the nature of the long-term tissue reactivity. Biomechanical effects specific to the more rigid implant fixation resulting from bone ingrowth must be considered in the design and use of such implants, since deleterious bone remodeling can develop.

A unique characteristic of porous-surfaced implants with 3-dimensional inter-connected porosity is the possibility of secure attachment of the implants to surrounding bone via a non-mineralized fibrous connective tissue layer. Studies of porous-surfaced implants stabilized in this manner have been reported. Fixing an implant to bone through a viable ligament-like tissue offers possible benefits over the rigidly fixed, bone-ingrowth implants.


5. Histological Investigation of the Healing Response Adjacent to Porous-surfaced Titanium Alloy Oral Implants in Dogs*


The osseointegration system developed by Branemark and his co-workers is by far the most successful oral implant system yet developed. The screw-threaded implant geometry used represents a design that can become mechanically interlocked with bone, assuming that bone newly formed during remodeling is in contact with the implant. Once this interlock occurs, stresses are transferred uniformly between the implant and bone along the length of the threaded portion.

A threaded implant is not the only form, however, which permits this uniform stress distribution. A similar situation can develop with porous-surfaced implant designs, which achieve fixation by bone ingrowth. The establishment of implant fixation by bone ingrowth into porous-surfaced implants has been studied extensively by Pilliar and co-workers. Other investigators using different materials and porous-surfaced designs have also demonstrated osseous fixation through ingrowth. The conditions necessary for bone ingrowth to occur are: initial implant stability, i.e., an initial healing period during which the implant is not in function or subject to any gross mobility; a sufficiently large pore size to permit bone ingrowth; and use of a biocompatible material. The recommended pore size is in the range of 100 to 400 µm as this encourages the ingrowth of bone rather than fibrous connective tissue. Titanium and its alloy, Ti6A14V have been used successfully for porous-surfaced implants.
We have developed a titanium alloy endosseous oral implant system, which incorporates a porous-surfaced geometry with a tapered conical implant shape. We are presently testing this implant system in dogs. The first experiment, which is partially reported here, was designed to determine a suitable healing period for porous-surfaced titanium alloy implants placed in the premolar areas of partially edentulous dog mandibles.


6. Effect On The Surface Geometry of Smooth and Porous-Coated Titanium Alloy On The Orientation of Fibroblasts In Vitro

T. Inoue, J.E. Cox, R.M. Pilliar, and A.H. Melcher

The migration and orientation of human gingival fibroblasts in relation to the rim of smooth-surfaced and porous-coated titanium discs placed on multilayers in vitro was investigated. Samples were examined after 6 h, 24 h, 3 days, and 7 days of culture using phase-contrast and scanning electron microscopy. The cells migrated from the multilayer onto the smooth-surfaced discs forming bridges between them, and orientated along parallel circumferential grooves in the rim of the discs. This resulted in the cellular bridges orientating at an acute angle to the rim of the disc, and adjacent cells in the multilayer orientating parallel to the rim. Cellular bridges were also formed between the porous-coated discs and the multilayer but, because the cells that migrated onto, and between, the spheres of the porous-coat showed no preferred orientation, the bridges retained their orientation at right angles to the surface of the rim. This in turn resulted in the cells of the adjacent multilayer becoming similarly orientated. These observations suggest that the geometrical configuration of the surface of implants could influence whether a capsule or an orientated fibrous attachment is developed in relation to implants in vitro.


7. Evaluation of Shear Strength At The Cement-Endodontic Post Interface

C. Maniatopoulos, R.M. Pilliar, and D.C. Smith
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Excessive axial loading of endodontic implants (posts) cemented into the root canals of teeth results in failure at the cement-post interface when smooth posts are used, whereas threaded or porous-surfaced posts fail at the cement-dentin interface. Similar results are expected for endodontic dowels because the two systems are similar. Micro mechanical interlocking of the cement to the dentin should increase the shear strength of the cement-dentin interface. This enhancement could be accomplished by removing the smeared layer from the root canal walls with EDTA or by mechanical preparation of serrations into the dentinal surfaces. A stronger cement-dentin interface could result in the load-bearing capabilities of even porous-surfaced or threaded posts or dowels being limited by the cement-implant interface strength.
This study measured the strength of the cement-implant interface for posts prepared with different surface geometries and cemented with different cements. Specifically tensile and torsional shear strengths were determined.

*J Prosthet Dent 1988; 59:662-669*

**8. Evaluation of The Retention of Endodontic Implants**

C. Maniatopoulos, R.M. Pilliar, and D.C. Smith

Studies evaluating the retention of endodontic implants have revealed that threaded surfaces lead to superior strength. Judy et al. and Zmener reported substantially stronger retention for threaded endodontic implants compared with smooth-tapered implants in vitro for single-rooted human teeth. Similar results for threaded endodontic dowels compared with smooth-tapered dowels were also reported. These studies also were performed in vitro and tensile tests were used to evaluate retention.

In addition, the effect of the cement on retention has been studied. Standlee et al. reported greater retention for smooth-tapered dowels with zinc phosphate compared with polycarboxylate and epoxy cements. Conversely, Young et al. reported superior retention for smooth-tapered cast dowels with polycarboxylate cement compared with zinc phosphate.

Finally, Hanson and Caputo reported improved retention for serrated dowels with cyanoacrylate compared with zinc phosphate and polycarboxylate cements. However, other studies did not indicate the effects of different cements on the retention of implants or dowels.

This study investigated the retentive strength of endodontic implants measured by forced removal (pull-out or push-out) as a function of implant design and cement. A smooth-tapered implant, a threaded implant, and a new porous-surfaced endodontic implant were evaluated. Porous-surfaced implants have been examined for orthopedics and dentistry to improve fixation at the implant-bone interface by direct bone ingrowth or by interlock with an intermediary grout or bone cement. Our study also explored the potential advantages of this design in endodontics.

*J Prosthet Dent 1988; 59(4): 438-446*

**9. Cell Attachment of Human Gingival Fibroblasts in vitro to Porous-Surfaced Titanium Alloy Discs Coated With Collagen and Platelet-Derived Growth Factor**

B.F. Lowenberg, R.M. Pilliar, J.E. Aubin, J. Sodek and A.H. Melcher

The influence of biological coating, with or without the incorporation of growth factor, on the migration, attachment and orientation of human gingival fibroblasts in relation to porous-surfaced titanium alloy (Ti6A14V) discs, was measured. Comparison was made between coating the discs with collagen and with collagen incorporating platelet-derived growth factor (PDGF); controls comprised porous-surfaced discs coated with agar or collagen containing bovine serum albumin (used as a carrier for the PDGF), uncoated porous-surfaced Ti6A14V discs (with or without additional protein additives) exhibited significantly higher attachment indices (A1) and orientation indices (O1) compared with naked control discs.
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(p<0.01); O1 was also significantly higher than that of surface-demineralized root slices (p<0.01) on days 1, 2 and 3. Addition of PDGF to the collagen resulted in a further enhancement of O1 on days 1 and 2 (p<0.01) over that shown by discs coated with collagen incorporating the bovine serum albumin vehicle. There was no cell attachment and consequently, no cell orientation, in relation to Ti alloy discs that had been coated with agar. These data suggest that attachment and orientation of cells following migration in relation to porous-surfaced Ti6Al4V discs can be modified by the application of biological molecules to the surface of the disc. This may have a useful application in clinical implantology.

Biomaterials 1988; 9:302-309


R. Todescan Jr., R.M. Pilliar, A.H. Melcher, V.E. Sodek and R.M. Aubin

A small animal model to investigate materials and implant designs intended for use as immediate replacements for extracted teeth has been developed. The effect of biological graft materials such as mineralized bone powder, demineralized bone powder, and collagen (Zyderm) on healing in relation to an endosseous porous-coated Co-Cr alloy implant placed into an extraction socket is reported. Testing of the data by analysis of variance revealed that the use of graft material improved healing by bone significantly (P<0.1). The Duncan Multicomparison Test (æ = .05) showed that Zyderm produced significant improved healing over the demineralized bone powder and implant alone.


D.A. Deporter, P.A. Watson, R.M. Pilliar, T.P. Howley, and J. Winslow

We have previously reported the clinical and radiographic findings of a trial in dogs of a new dental implant system after a functional period of eight months. The present report consists of the corresponding qualitative and quantitative histological data. The implant system was fabricated from Ti-6Al4V and employed a porous-surfaced configuration to achieve implant fixation by bone ingrowth. A similar porous surface was used on the apical 1/3 of the transgingival collar in an attempt to gain ingrowth and attachment of gingival connective tissue. The qualitative histological data confirmed that while such attachment to the collar did occur for some implants, in the majority of implants (22 of 32) the porous region of the collar became contaminated with bacterial plaque, resulting in implant failure (four implants) or suggesting future implant failure (18 implants) Statistical analyses of the quantitative histological data indicated that there were no significant differences in surface contact of bone with the middle third of the porous implant surface (CLEF) when initial healing interval (four or eight weeks), implant location, or aspect of implant buccal vs. lingual vs. mesial vs. distal) were compared. However, comparison of the current group of functional implants with an earlier group of similarly implanted non-functional implants indicated that function produced a highly significant increase in CLF.
12. Surface Characteristics of Dental Implant Materials

D.C. Smith, R.M. Pilliar and N.S. McIntyre

The cellular response to and a trace element released from implant material are conditioned by their surface characteristics. The effects of commonly used preparative procedures on porous and solid samples of Ti6Al4V, Co-Cr-Mo, single crystal Al2O3 and synthetic hydroxyapatite (HA) have been studied by SEM, EDX, ISS, SIMS and ESCA. Some of the results for Ti6A14V and HA discussed here show that the surface of implant materials may be highly variable as a result of uncontrolled preparative procedures. Standardized preparative procedures and adequate characterization are needed to understand the interaction between tissues and implant materials.

Progress in Biomedical Engineering, 7, Oral Implantology and Biomaterials; 185-192, Elsevier Science Publ. B.V., Amsterdam, 1989

13. A Histological Comparison in the Dog of Porous-Coated vs. Threaded Dental Implants

D.A. Deporter, P.A. Watson, R.M. Pilliar, M.L. Chipman, and N. Valiquette

The histological findings of an 18-month trial, in the dog, of a partially porous-coated endosseous dental implant made of Ti-6A1-4V, with a truncated conical shape, are described and compared with those for a cylindrical, threaded, endosseous implant made of commercially pure Ti. Six beagle dogs each received two porous-coated implants on one side of the mandible and two threaded implants on the contralateral side. Each set of two implants supported a two-unit fixed bridge for an 18-month functional period. Methylmethacrylate sections of both the buccolingual and mesiodistal aspects of each implant were examined qualitatively and by computer-assisted morphometry. The Morphometric measurements were used for determination of the length of implant surface in direct contact with bone on each aspect of each implant. The data were expressed both as an absolute length and as a fraction of the maximum length available for contact (contact length fraction or CLF). On the buccal and lingual aspects of the implants, both the absolute lengths and CLF were significantly smaller for the porous-coated design. For the mesial and distal aspects, the absolute lengths and CLF were less for the porous-coated design, but the differences were not significant. However, when the absolute contact length was related to the corresponding vertical bone height, significant differences were observed, the absolute contact length being greater for any given bone height for the porous-coated design. Taken together, the data suggest that shorter implants may be used with the porous-coated design.


R.M. Pilliar
Animal studies using porous-surfaced Ti-6Al4V endosseous dental implants have demonstrated their suitability for achieving rigid fixation through bone ingrowth. Further, direct comparison of porous and threaded implant designs have indicated possible advantages of the porous-surfaced designs when early implant loading occurs.

*Progress in Biomedical Engineering, 7, Oral Implantology and Biomaterials; 151-161, Elsevier Science Publ. B.V., Amsterdam, 1989*

**15. Dental Implants: Materials and Design (Specialty Feature)**

Pilliar, R.M.

The use of endosseous dental implants represents one of the most rapidly expanding areas of dentistry. This article attempts to summarize the current understanding of factors affecting dental implant success. The need continues for further fundamental studies to provide a base for future improvements in the design and use of dental implants.

*J Canad Dent Assoc 1990; 56(9): 857-861*

**16. Dental Implant Design - Effect on Bone Remodelling**

R.M. Pilliar, D.A. Deporter, P.A. Watson, and N. Valiquette

Bone remodeling around three different endosseous dental implant designs placed in dog mandibles were studied using radiography during lengthy periods of function and by histology after animal sacrifice. The three designs investigated were (a) threaded (C.P. titanium), (b) fully porous-coated (titanium alloy), and (c) partially porous-coated (titanium alloy). The implants were kept in function for either 32 weeks (fully porous-coated) or 73 to 77 weeks (partially porous-coated and threaded). The studies indicated that some crestal bone loss occurred for both the threaded and partially porous-coated implants while no significant bone loss was seen with fully porous-coated implants in the absence of plaque-associated infection. It is suggested that these observed differences are a result of the different stress states that develop in bone surrounding the three designs underlying the importance of implant design on bone remodeling.

*J Biomed 1991; 25:467-483*

**17. The Effect of Partial Coating with Hydroxyapatite on Bone Remodelling in Relation to Porous-coated Titanium-alloy Dental Implants in the Dog**


For inhibition of crestal bone resorption due to stress shielding and disuse atrophy, a hydroxyapatite (HA) plasma coating was added to the coronal portion of partially porous-coated endosseous dental implants. These implants, as well as control non-HA-coated implants were placed in healed mandibular premolar extraction sites in dogs for a 72-week
period of function. Histological examination showed that both implant designs became securely fixed by bone ingrowth into the porous-coated apical region of the implants. The plasma-sprayed HA coating resulted in significantly greater bone height formation and maintenance next to the coronal portion of the implant compared with non-HA-coated implants of similar design. In addition, significant resorption of the 20-to-50-µm-thick plasma-sprayed HA coating occurred over the 18-month period of function.

\(J\text{ Dent Res 1991; 70:1338-1345.}@\)

18. **A Clinical Trial of a Partially Porous-Coated, Endosseous Dental Implant in Humans: Protocol and 6 Month Results**

D.A. Deporter, P.A. Watson, R.M. Pilliar, M. Pharoah, M. Chipman, and D.C. Smith

Dental implantology has become a rapidly developing field of research and clinical application since Branemark and co-workers reported their results of a 15 year follow up in humans treated with a threaded implant design of pure titanium. The Branemark system, however, is considered by some to be expensive, complicated to place, and technique-sensitive. There is, therefore, a need for simpler, less invasive, and biologically more compliant dental implant systems that could be used reliably by a wider group of practitioners.

We have previously reported on the design and testing in dogs of a new partially porous-coated endosseous dental implant system that appears to have several advantages over threaded implant designs. The implant root component is fabricated from Ti-6Al-4V, has a tapered, truncated cone shape to facilitate implant placement and optimize stress transfer at the bone/implant interface and utilizes a powder-sintered, porous surface topography to promote integration by means of bone ingrowth over selected regions of the implant. In a comparative study in beagle dogs, this implant performed as well as a threaded implant system of pure titanium over an 18-month functional period. However, the results indicated that porous-coated implants could be shorter than threaded implants because of the increased surface area per unit length of implant available for bone ingrowth with the porous design. This report is concerned with an experimental protocol and 6 month results from the first human trial in which this partially porous-coated implant system has been used to treat completely edentulous patients, the majority of whom had severe mandibular alveolar ridge resorption. In keeping with our objective of developing simple treatment approaches that would be relatively inexpensive and applicable by a large group of practitioners, these patients were managed using three implants in the anterior mandible and a removable overdenture.

*Tissue Integration in Oral, Orthopedic and Maxillofacial Reconstruction; Eds. W.R. Laney and D.E. Tolman, Quintessence Books, Chicago 1992; 250-258*

19. **University of Toronto Researchers Develop New Dental Implant System**

D.A. Deporter, R.M. Pilliar, P.A. Watson and M. Pharoah

*Alumni Today, Faculty of Dentistry; May 1992; 12-1*

20. **Partially Porous-coated Dental Implants - 2 Year Human Clinical Trial Results**
D.A. Deporter, R.M. Pilliar, P.A. Watson and M. Pharaoh

We have previously reported on the design and testing in dogs of a new porous-surfaced, endosseous dental implant system (Deporter et al., 1986, 1988, 1990; Pilliar et al., 1990, 1991). The implant root component made from Ti-6Al-4V has a tapered, truncated-cone shape for ease of placement, and utilizes a powder-sintered porous surface topography over the majority of its length to promote fixation by bone ingrowth. In a first human clinical trial with this implant ("Endopore™"), we have placed 3 implants each in the anterior mandible of 52 edentulous individuals and used them to support mandibular overdentures. Data being collected include standardized radiographs (using a customized film holder connected to each implant) analyzed with computer-assisted techniques, and trace elements analyses of blood (using atomic absorption spectro-photometry) for Ti, Al and V. Two-year results for more than half the patients and one-year results for the remaining patients will be presented. As predicted from the animal work, crestal bone remodeling begins to level off by 12 months, and is not progressive beyond the coronal-most limit of the porous coat. No significant changes from baseline in blood levels of Ti, Al and V were observed.

AADR Abstr #1201 Dent Res 1992; 71:256

21. Bone Remodeling in Relation to Porous-coated Titanium Alloy Dental Implants

D.A. Deporter, R.M. Pilliar, P.A. Watson, M. Pharoah, H. Vaillancourt and N. Valiquette

In this investigation the patterns of bone remodeling around 3 designs of endosseous dental implants were studied using standardized, sequential radiographs. All 3 designs had a truncated conical shape, were fabricated from Ti-6 Al-4V and had a porous coat of beads of the same alloy. They differed in that one design included a porous coat over its entire periphery (fully porous-coated-FPC), while the other two were only partially porous-coated. One of these two had a machined alloy surface on its coronal third (PPC) while the other (PPC-HA) had a plasma-sprayed coat of hydroxyapatite in this region.

The results showed that no crestal bone loss occurred with the FPC implants over an 8-month functional period, unless the porous coat had become contaminated with dental plaque at the re-entry stage resulting in peri-implant infection. With both PPC designs the crestal bone remodeled with time in function until it reached a point just coronal to the machined surface (or HA coat) -to-porous coat junction after which it became stable. No statistically significant difference in crestal bone loss between the two PPC designs could be detected using radiographic analysis, although earlier histological analysis of the same implants did reveal a small but significant difference, with less crestal bone loss occurring with the PPC-HA design.

It is concluded that a porous coat of beads of Ti-6Al-4V provides an effective means of stress transfer from implant to bone around endosseous dental implants with a truncated conical shape.

Furthermore, bone remodeling around such implants can be controlled by altering the extent of porous coating and possibly by the addition of hydroxyapatite to selected regions of the implant surface.

22. Predictable Crestal Bone Remodelling Around Two Porous-Coated Titanium Alloy Dental Implant Designs, A radiographic study in dogs


We have previously suggested that altering the height of the porous-coat segment of a partially porous-coated TiAl₆V₄ endosseous dental implant would affect the degree of crestal bone loss occurring during implant function by changing the patterns of stress transfer. This conclusion arose from the analysis of data from several different experiments and lacked a direct intra-animal comparison. In the present study we have compared two implant designs varying only in the extent to which they were porous-coated. With one design (type A) the coronal 1.8 mm of the implant root had a machined surface while the remainder of its length was porous-coated with TiAl₆V₄ beads. The other design (type B) had all but the coronal-most 0.75 mm porous-coated. Two implants of each type were placed in each of 4 dogs and the sites allowed to heal for 4 weeks before re-entry and prosthesis attachment. Monthly the implant-supported bridges were removed and radiographs exposed of each implant using a special film holder connected separately to each implant. These radiographs were analyzed for crestal bone loss using both direct visual and computer-assisted techniques. The results showed that bone remodeled to the machined surface-to-porous coat junction for type B implants and achieved a steady state by 12 weeks of function, whereas a longer time was required to achieve this state with type A implants. Significantly more bone loss occurred with the type A design, and this difference was detectable as early as after the first month of function.


23. Finite Element Analysis of Crestal Bone Loss around Porous-Coated Dental Implants

H. Vaillancourt, R.M. Pilliar, and D. McCammond

Crestal bone loss is observed around various designs of dental implants. A possible cause of this bone loss is related to the stresses acting on periimplant bone. To investigate the relationship between stress state and bone loss, two-dimensional finite element models corresponding to bucco-lingual and mesio-distal sections of canine mandibles with one of two designs of porous-coated dental implants were analyzed. A fully porous-coated design consisting of a solid Ti6Al4V core had a porous coating over the entire outer surface of the implant component, while a partially porous-coated design had the porous coating over the apical two-thirds of the implant surface only. Occlusal forces with axial and transverse components were assumed to act on the implant with interface bonding and effective force transfer at all porous coat-bone interfaces and no bonding for the non-porous-coated regions. The results of the analysis indicated that at most implant aspects (buccal, lingual, mesial, and distal), the equivalent stresses in crestal bone adjacent to the coronal-most, non-porous-coated zone of the partially porous-coated implants were lower than around the most coronal region of the fully porous-coated implants. The region of lower stresses around the partially porous-coated implants corresponded to observed areas of crestal bone loss in animal studies,
suggesting that crestal bone loss in this case was due to bone disuse atrophy. A number of parameters of the finite element models were varied to determine the effect on the resulting stress fields and, therefore, possible long-term bone remodeling. Based on differences in observed bone structures by histological examination and results of finite element analyses with fully and partially porous-coated implants, an equivalent stress equal to 1.6 MPa was determined to be sufficient to avoid bone loss due to disuse atrophy in the canine mandibular premolar region.

*J of Applied Biomaterials* 1995; 6:267-282

24. Initial Healing in the Dog of Submerged Versus Non-Submerged Porous-Coated Endosseous Dental Implants

D. Levy, D.A. Deporter, R.M. Pilliar, P.A. Watson, N. Valiquette

It has previously been reported that porous-coated root form endosseous dental implants, became well integrated when used in the traditional 2-stage surgical approach. In this study, the placement of the implant in a 1-state (non-submerged) technique was to be explored. Implants were placed in the mandibles of dogs, and 2 designs were used differing only in that one (experimental) had a 3-mm transgingival extension, permitting it to be exposed to the oral cavity from the outset. 12 (3 per animal) non-submerged implants were placed contralaterally. All implants were allowed to heal for 6 weeks, after which histological preparations were made. 2 of 12 non-submerged implants were lost due to post-operative complications; otherwise, all implants healed uneventfully. Histomorphometric analysis revealed bone-implant contact, as assessed by absolute bone contact (ABC) and contact length fraction (CLF), to be greater for the submerged design, suggesting that bone healing may be delayed with the non-submerged approach. As well, at this early stage of healing, for both implant designs, ABC and CLF were significantly greater on proximal than on buccal and lingual aspects.


25. Affecting Crestal Bone Loss With Dental Implants Partially Covered With a Porous Coating: A Finite Element Analysis

H. Vaillancourt, BASc, MASc, PhD, R.M. Pilliar, BASc, PhD, D. McCammond, BSc, PhD

Limited crestal bone loss has been observed around dental implants partially covered with a porous coating. The results of a two-dimensional finite element analysis suggested that for this implant design, the observed crestal bone loss is the result of low stresses acting on bone around the uncoated superior region of the implant, causing disuse atrophy of bone. This finite element study investigated the effect on crestal bone loss of varying the design of the prosthesis connecting pairs of implants, the length of the uncoated region of the implant, and the friction at the noncoated coronal portion of the implant and adjacent host bone.


26. Simplifying the Treatment of Endentulism: A New Type of Implant
D.A. Deporter, DDS, PhD, P.A. Watson, DDS, MScD, and D. Booker

In this article, the authors describe the application of a new and unique root-form dental implant in a simplified approach to treating the completely edentulous mandible using an overdenture. The technique is supported by the results of a prospective clinical trial involving 52 patients that showed a three- to four-year success rate of 95 percent.

*JADA 1996; 127:1343-1349 - @*

27. Prospective Clinical Study in Humans of an Endosseous Dental Implant Partially Covered With a Powder-Sintered Porous Coating: 3- to 4-Year Results

D.A. Deporter, P.A. Watson, R.M. Pilliar, M. Pharaoh, D.C. Smith, M. Chipman, D. Locker, and A. Rydall

A dental implant covered partially with a porous coating (Endopore) developed at the University of Toronto was tested. This new implant is a tapered, truncated-cone endosseous root-form implant fabricated from Ti-6Al-4V. It utilizes a powder-sintered porous surface geometry over most of its length to promote three-dimensional bone ingrowth and implant stabilization. In this trial, three implants were placed in the anterior mandibles of 52 patients and were used subsequently as freestanding units to support an overdenture. Much shorter implants, shorter initial healing periods, and simpler surgical techniques than are customary with other implant designs were used. At the time of this report, all patients with implants had passed 3 years of function, and the cumulative implant success rate was 94.8%. Analysis of carefully standardized radiographs revealed a pattern of crestal bone loss similar to earlier published dog data. On a yearly basis, the mean bone loss was 0.43 mm in year 1, 0.17 mm in year 2, and 0.13 mm in year 3.

*Int J Oral Maxillofac Impls 1996; 11(1): 87-95*

28. Periodontal Parameters Around Porous-Coated Dental Implants after 3 to 4 Years Supporting Overdentures

D. Levy, D.A. Deporter, P.A. Watson, and R.M. Pilliar

In this study, an assessment using modified periodontal indices was done on a group of 48 fully edentulous patients who had each been treated with 3 porous-coated (Endopore®) dental implants and a mandibular overdenture. Parameters assessed included plaque index (PI), sulcular bleeding index (SBI), pocket probing depth (PD), probing attachment level (PAL) and mobility (M) using a Periotest device. At the time of the assessment, all of the patients had passed 3 years of continuous function while 26 had passed 4 years. Approximately 50% of implant surfaces were plaque-free while 79% of surfaces showed no bleeding upon probing. There was no correlation between PI and SBI. The mean PD was 3.1 mm with 64% of sites #3.5 mm. Mobility measurements taken with the Periotest device gave a mean PTV of (-4.35) with 96% of
measurements (-0.5). No significant correlations were found between mobility and either PAL or implant length.


29. **Clinical Evaluations of a Porous-Surfaced Endosseous Implant System**

A.L. Heller and R.L. Heller

Clinical evaluations of a new porous-surfaced implant concept (Endopore®) in a large population of fully and partially edentulous patients are reported, and a technique of spreading buccal and lingual plates with osteotomes to place these implants in proximity to the sinus of the posterior maxilla is described. Three-dimensional, interconnecting pores on this implant's bone interface surface give a great surface area for bone engagement. When the maxilla is prepared by this spreading procedure, these implants can be successfully placed in areas having limited available bone. Our success rates are 97.0% for implants stabilizing a mandibular overdenture and 94.8% for implants placed in partially edentulous patients. Many times, sinus lift or other augmentation procedures can be avoided in the maxilla and mandible, allowing for less patient morbidity and for an implant reconstruction that is more affordable for the patient.

*J Oral Implant* 1996; 22(3&4): 240-246

30. **Utilisation de l'implant dentaire ENDOPORE®: Technique et resultats d'essais cliniques d'une duree de 5 ans chez des porteurs de prothese mandibulaire sur implants.**

D.A. Deporter, P.A. Watson, A. Heller, R. Heller, et R.M. Pillar

Le present rapport vise deux objectifs: premierelement decrire les protoles chirurgicaux et prothetiques suivis lors de l'utilisation des nouveaux implants ENDOPORE® chez des sujets presentant une edentation mandibulaire complete, et deuxiemement presenter les resultats de deux essais cliniques effectues chez ces sujets. Endopore® est un nouveau systeme implantaire facile a utiliser, il est dote d'une surface unique qui permet l'osteo-integration par interposition osseuse. Le premier essai a ete effectue a l'Universite de Toronto en 1989, chez un groupe de patient’s forme en vue de la mise au point du systeme implantaire Endopore®. Le taux de reussite du traitement implantaire lors de ce premier essai d'une de 5 ans a atteint 93.4% comparativement a 95.1% obtenu lors d'un deuxieme essai realise plus tard en pratique privee, aux Etats-Unis, chez des patients suivis pendant des periodes allant jusqu'a 3 ans.

31. **A Comparison of Radiographic Bone Height and Probing Attachment Level Measurements Adjacent to Porous-Coated Dental Implants in Humans**

D. Levy, D.A. Deporter, M. Pharaoh, and G. Tomlinson
The changes in crestal bone height observed in standardized radiographs of porous-coated dental implants after 3 to 4 years of function in the support of mandibular overdentures is reported for a group of 48 completely endentulous patients. Possible correlations between bone height and each of probing attachment level, Plaque Index, and Sulcular Bleeding Index were investigated. Mean bone loss values were determined to be 0.43 mm in year 1, decreasing to 0.17 mm and 0.13 mm in years 2 and 3 respectively. During year 4, there was an apparent mean gain of 0.05 mm. While the mean mucosal tissue thickness (1.3 mm) was similar to that reported by other investigators, it was not possible to show a correlation between bone height and Plaque Index or between bone height and Sulcular Bleeding Index could not be demonstrated.


32. Systemic Metal Ion Levels in Dental Implant Patients

D.C. Smith, S. Lugowski, A. McHugh, D. Deporter, P.A. Watson, and M. Chipman

Metal ion release from metallic implants is known to occur but its extent and implications are controversial. Little is known of the metal ion release from dental implants in spite of the rapidly growing number of such implant patients. Blood levels of Ti, Al, and V were measured using an atomic absorption spectrophotometric technique preoperatively and at intervals over a 3-year period for 52 patients (17 M 35 F) each having 3 mandibular porous-surfaced endosseous dental implants. The results showed that there was no evidence of change from preoperative to long-term values for the three metals measured in the study.


33. Use of the Endopore® Dental Implant to Restore Single Teeth in the Maxilla: Protocol and Early Results

D.A. Deporter, R. Todescan, P. Watson, M. Pharaoh, D. Levy and K. Nardini

This report outlines the experimental, surgical and prosthodontic protocols for a prospective clinical trial using the Endopore® dental implant to replace single maxillary teeth. Twenty patients (10 male, 10 female) ranging in age from 30 to 60 yrs each received one implant (mean length 10.1 mm), which, after an initial healing interval of 4 months, was restored with a single crown. Records collected included radiographs, Periotest mobility measurements, supragingival Plaque Index, and an assessment of peri-implant soft tissue health using pocket probing depths, sulcular bleeding following probing, and probing attachment levels. Radiographs were exposed at predetermined intervals following crown placement (1 and 6 months, and then yearly) in a standardized procedure using a specialized filmholder that attaches to each implant after removal of the crown. At the time of this preliminary report, all of the 20 implants placed had been uncovered and were in function; 16 of the implants have been in function for 6 months or more, 14 had passed 1 year of function, and 3 had passed the 2-year function point. There have been no failures to date.

34. 6-7 Year Results of a Prospective Clinical Trial using ENDOPORE® Implants to retain a Mandibular Overdenture.

D.A. Deporter, P.A. Watson, R. Todescan, M. Pharaoh, A. Heller, R. Heller

This is a 6 to 7 year report on 52 fully edentulous patients treated at the University of Toronto each with freestanding ENDOPORE® implants (mean length 8.7mm) in the anterior mandible and an overdenture. This tapered endosseous implant device has a multilayered surface coat of spherical particles of Ti-6Al-4V (45 to 150um dis.) greatly increasing its surface area for osseointegration and allowing 3-dimensional interlocking by bone ingrowth, making possible the routine use of short implants. Three patients have died and one was lost to follow-up after 4 years. The 5-year cumulative survival rate for the remaining patients was 93.4% and this figure remains unchanged to date when all remaining patients have completed 6 years and 21 have completed 7 years of function. The pattern of crestal bone loss was similar to that predicted from our earlier animal work, although the peri-implant crest took longer to stabilize at the level of the junction of the machined collar-to-porous coat junction. Mean crestal bone loss in highly standardized radiographs, in the first year 0.45mm, and this decreased to 0.17mm and 0.13mm in years 2 and 3. There was no significant change in mean bone height at years 4 or 5, and this equilibrium continues to be maintained at 7 years based on radiographs of those 21 patients who have passed this time point. The overall mean annual bone loss from years 2 through 7 was 0.03mm, i.e. clinically insignificant. The results of this study have now been replicated in a private practice setting using an identical treatment protocol and show a 3-year survival rate of 96.1%

Abstr. Submitted to Annual Meeting of the Academy of Osseointegration, Atlanta March 1998

35. A Clinical Trial of Partially Coated Endosseous Dental Implant In Japan. Protocol and 6-Month Results

B. Ogiso, N. Komori, T. Tomita, I. Ogihara, S. Mezawa and T. Saito

Porous-coated endosseous dental implants (Endopore™ Implant) newly developed, with achievements of the MRC program for dental implantology at the Faculty of Dentistry, University of Toronto, Canada, were initially applied to 35 of Japanese patients as a clinical trial in Japan from July 1994. This implant has a unique surface geometry with powdersintered bead layers on the surface of the fixture promoting three-dimensional interlocking with bone, and this surface structure leads to reduction of implant length with an increased bone contact area on its surface. It consequently produces firmer bone support of implants. Partially edentulous cases of the mandible were mainly selected, and 1 to 3 implants (total: 78 implants) were placed under a certain surgical procedure previously performed at the University of Toronto.

As a clinical evaluation, observation of the peri-implant tissue condition by Gingival Index, measurement of peri-implant pocket depth, measurement of implant mobility with Periotest device, and clinical observation of the bone condition around implants with radiographs were performed.

In addition, a questionnaire was given to patients after 6 months function in order to determine the condition of oral function and patients satisfaction with the implant. After 6-
month function, 75 of the implants have been keeping normal function (survival rate: 96.2%) and no abnormal aspect suggesting infection, bone resorption, or implant mobility, which could cause implant failure, was observed. This implant has many favorable characteristics for clinical application such as a firm bone support with bone ingrowth into a three dimensional network of pores, an easy placement of the implant fixture by a simple surgical procedure and a downsizing of implant length resulting in application to a wide range of clinical cases compared to former implant systems. They must contribute to spread implant therapy to general clinical practice.


36. The Endopore Implant-Enhanced Osseointegration with a Sintered Porous-Surfaced Design

R.M. Pilliar, D.A. Deporter, P.A. Watson and R. Todescan

All currently used endosseous dental implants rely primarily on mechanical interlock of implant and host bone to achieve reliable implant fixation by osseointegration (i.e. close bone-to-implant apposition resulting in functionally rigid fixation). Various implant surface designs have been introduced to promote this condition including machined, grit based, acid-etched and plasma sprayed surfaces as well as combinations of these treatments1 (e.g. grit-blasted and acid-etched). Even the so-called bioactive surface compositions, usually consisting of plasma-sprayed calcium phosphate layers (nominally calcium hydroxyapatite) rely primarily on the development of an irregular or rough surface to allow bone-to-implant mechanical interlock. The irregular surface geometry of all the aforementioned surface design provides resistance to interfacial tensile forces. A 3 dimensionally-interdigitated structure of bone and implant that would provide resistance to interfacial tensile forces cannot develop with these types of surfaces since the bone can only grow into surface depressions or intrusions and not throughout openings within an implant surface zone. Since both transverse and vertical forces act on dental implants during the healing stage following implantation, there is little resistance provided against tensile forces acting at the interface caused by a transverse tipping forces. As a result, relatively lengthy non-functional periods (three to six or more months typically, depending on the host bone quantity and quality), and sufficiently long implant lengths (>10mm in the mandible and >13mm in the maxilla) are required to ensure reliable implant performance.

Oral Health July1998; 61-64

37. Overview of Surface Variability of Metallic Endosseous Dental Implants: Textured and Porous-Structured Designs

R.M. Pilliar

A variety of successful endosseous dental implants with different surface forms are currently available for clinical use. These all achieve implant-to-bone fixation primarily (if not totally) through mechanical interlock of bone with implant surface features introduced by design or chance during implant fabrication. Equally important to establishment of rigid fixation is the rate at which it is achieved, because faster rates allow earlier implant loading and less chance of inadvertent early loading that might prevent implant “osseointegration”. Investigations of
surface modification to favorably affect osteoconductivity and bone bonding represent an active area of research in the field of dental implant development. This article presents a review of available surface designs and future research directions for improved devices.


38. Use of the Endopore Dental Implant to Restore Single Teeth in the Maxilla: Protocol And Early Results.

D. A. Deporter, R. Todescan, P. Watson, M. Pharoah, D. Levy, and K. Nardini

This report outlines the experimental, surgical, and prosthodontic protocols for a prospective Clinical trial using the Endopore dental implant to replace single maxillary teeth. Twenty Patients (10 male, 10 female) ranging in age from 30 to 60 years each received one implant (Mean length 10.1mm), which, after an initial healing period of 4 months, was restored with a single crown. Records collected included radiographs, Periotest mobility measurements, Supragingival Plaque Index, and an assessment of peri-implant soft tissue health using pocket Probing depths, sulcular bleeding following probing, and probing attachment levels. Radiographs were exposed at predetermined intervals following crown placement (1 and 6 Months, and then yearly) in a standardized procedure using a specialized film holder that Attaches to each implant after removal of the crown. At the time of this preliminary report All of the 20 implants placed had been uncovered and were in function; 16 of the implants Had been in function for more than 6 months or more, 14 had passed 1 year of function, and 3 had passed the 2-year function point. There have been no failures to date.


39. Experience with Dental Implants Patients at Riyadh Forces Hospital

A.A. Al-Sayyed, K. Fareed, Y. Shibat-Al-Hamd, T. Jamous and J. Laidlaw

Objective: To present the first experience with dental implants in treating patients with missing teeth at Riyadh Armed Forces Hospital.

Methods: Fifty healthy adults aged 22-65 years were selected for the treatment. They received a total of 75 titanium alloy Endo-Pore dental implants during the years 1995-1996. Patients were enrolled in the periodontal and prosthodontic clinics for screening and oral hygiene phase therapy before implant surgery. A 2-stage implant surgery technique was used followed by attachment of the prosthetic crown. Clinical and radiographic evaluations were obtained every 3-months after crown attachment for the first year and every 6 months for the 2nd and 3rd year.

Results: All patients treated with dental implants showed a 100% success rate, defined clinically as absence of mobility, pain, gingival inflammation or deep pockets and radiographically as absence of bone resorption.

Conclusion: The use of the Endo-Pore dental implant system in treating patients with missing teeth is very successful after 2-3 years of follow-up. Proper patient selection, surgical technique, prosthetic design, maintenance program and patient compliance have contributed to this result.
40. Five to Six Year Results of a Prospective Clinical Trial Using the Endopore Dental Implant and Mandibular Overdenture

D.A. Deporter, P.A. Watson, M. Pharoah, D. Levy and R. Todescan

The purpose of this report is two fold; firstly to describe the surgical and prosthodontic protocols for using the ENDOPORE® dental implant, a new user-friendly dental implant system that uses a unique surface topography to achieve osseointegration by bone ingrowth into the implant surface, for treatment of the completely edentulous mandible with an overdenture; and secondly, to present the results of two human clinical trials using the described protocols. Five-year results are available from one of the trials begun in 1989 at the University of Toronto as the "developmental" patient group for the implant system, and show 93.4% success. In a second trial conducted later in a private practice setting a success rate of 95.1% was achieved with patients followed for periods up to three years.


41. Use of a Tapered, Porous-Surfaced Dental Implant in Combination with Osteotomes to Restore Edentulism in the Difficult Maxilla

D.A. Deporter, R. Todescan and K. Nardini

The maxilla is the more difficult arch to restore with endosseous dental implants because of hurdles such as low bone density, narrow buccopalatal width, minimal bone height, and proximity to the maxillary sinus. In this article, a technique to resolve all of these problems using a short, tapered, porous-surfaced implant and a placement protocol using hand osteotomes rather than surgical burs are presented.


C.A. Simmons, N. Valiquette and R.M. Pilliar

The osseointegration and long-term success of bone-interfacing implants are dependent on mechanical stability of the implant relative to host bone during the early healing period. The geometric design of an implant surface may play an important role in affecting early implant stabilization, possibly by influencing tissue-healing dynamics. In this study, we compared the early tissue healing response and resulting implant stability for two surface designs by characterizing the histological and mechanical properties of the healing tissue around Ti6Al4V sintered porous-surfaced and Ti plasma-sprayed implants. The implants were inserted transversely in rabbit femoral condyles and evaluated at 0, 4, 8, and 16 days postimplantation. At 4 and 8 days after implantation, the early healing tissue (fibrin and collagenous matrix) was more extensively integrated with the three-dimensional interconnected structure of the sintered porous surface than with the irregular geometry of
the plasma-sprayed coating. In addition, histological examination indicated that initial
matrix mineralization leading to osseointegration occurred more rapidly with the porous-
surfaced implants. The more extensive tissue integration and more rapid matrix
mineralization with the porous-surfaced implants were reflected in the mechanical test data,
which demonstrated greater attachment strength and interfacial stiffness for the porous-
surfaced implants 4 and 8 days postimplantation \( p < .05 \). Sixteen days after implantation,
both implant designs were osseointegrated and had comparable attachment characteristics.
These data demonstrate that appropriate surface design selection can improve early implant
stability and induce an accelerated healing response, thereby improving the potential for
implant osseointegration.


**43. Simplifying Management of the Posterior Maxilla Using Short, Porous-Surfaced
Dental Implants and Simultaneous Indirect Sinus Elevation**

D. Deporter, R. Todescan and S. Caudry

This article describes the use of short, porous-surfaced root-form dental implants and an
indirect, simultaneous osteotome-mediated sinus elevation procedure to restore the posterior
maxilla when as little as 3 mm of bone remains below the sinus floor. Results with 16
patients who are part of an ongoing prospective clinical trial using the Endopore Implant
show 100% success (using established criteria) with a mean implant length of 6.9 mm and a
mean functional time of 11.1 months. This treatment approach greatly simplifies the
management of the posterior maxilla with minimal bone height below the sinus floor.

*Int J Periodontics & Restorative Dent 2000; 20(5) - @*

**44. Processing and Properties of Endosseous Dental Implant Surfaces: Design for
Increased Osseointegration Potential**

R.M. Pilliar

Successful treatment using endosseous dental implants is dependent on the formation and
maintenance of secure implant to host bone fixation. This criterion for success has been
recognized since the 1970s as a result of early reports by Branemark and co-workers on
successful use of threaded, screw-shaped cpTi implants placed using a careful two-stage
surgical procedure. A result of those early studies was the coining, by Branemark, of the
term ‘osseointegration’ which described virtual direct implant-bone contact as a necessary
requirement for success of dental implants.

*Oral Health August 2000; 51-58*

**45. Placement of a Two-Stage Implant System Using a One-Stage Technique. Evaluation
of Soft Tissue Healing and Osseointegration: A Pilot Study**

H.D. Barber
A pilot study was performed in order to evaluate the soft tissue response and osseointegration of a two-stage implant system placed using a one-stage surgical technique. The implant utilized in this study was designed as a classic two-stage implant system. The results of this pilot study indicated an excellent soft tissue response with successful osseointegration when this implant is placed using a one-stage technique.

*World Dentistry, Fall 2000*

www.worlddent.com

### 46. Porous-surfaced implants in maxillary partial edentualism: Clinical trial results

Deporter, D.A., Todescan, R., Watson, P., Pharoah, M., and Riley N.

50 patients received 151 Endopore® implants (mean length, 8.7mm) in the maxilla (76.8% posteriorly). 55.6% of implant crowns were splinted, while the remainder were not. Records were collected at baseline (one month after prosthesis), 6 mos, 1 & 2 yrs. To date, implant survival is 97.4% (four implants lost). Radiographs showed stable crestal bone levels with time, and no correlation between crestal bone level and whether implants were located anteriorly or posteriorly. Neither were there effects of implant length or diameter or splinting on bone levels. There was a significant positive correlation between PTV’s** and time, but not with implant length.

There was a highly significant correlation between implant diameter and mean PTV (increasing diameter = improved PTV). PTV values were better for implants located in the posterior than anterior maxilla. As well, mean PTV’s at all times were better for non-splinted implants. It is concluded that implants with a sintered porous surface geometry perform extremely well, even in short lengths in the maxilla. Crestal bone levels remain stable under function, and Periotest™ measurements of subclinical mobility indicate superior implant stability in the posterior vs. anterior maxilla and in non-splinted vs. splinted prostheses. Partial Funding provided be Innova Corporation, Toronto, Canada.

** Periotest™ values


### 47. A prospective human clinical trial of the ENDOPORE® dental implant in restoring the partially edentulous maxilla using fixed prostheses


This is the first report of a group of 50 partially edentulous patients who received a total of 151 Endopore® dental implants in the maxilla. A mean implant length of 8.7mm was used and 76.8% were placed in the posterior maxilla. At re-entry all implants appeared to be osseointegrated and were used to support fixed prostheses. Approximately half (57%) of the crowns in these prostheses were splinted to one another, while the remainder (43%) were not. At the time of this report the mean functional time was 34.6 months and the cumulative
survival rate was 97.3% as 4 implants failed. Analysis of carefully standardized sequential radiographs indicated no significant changes in mean crestal bone levels between baseline and any of the times 6 months, 1 year and two years in function. There were no detectable correlation between crestal bone loss and any of the factors implant length (7, 9 or 12mm), implant diameter (3.5, 4.1 or 5.0mm), implant position anteriorly or posteriorly in the maxilla, or whether or not the implant-supported crowns were splinted.

Inter J Oral Maxillofac Impls. 2001:16:527-536 @

48. Managing the posterior mandible of partially edentulous patients using short porous-surfaced dental implants. Design considerations and early data from a clinical trial

Deporter, D.A., Pilliar, R.M., Todescan, R., Watson, P., Pharoah, M., Kritsman, V.

Forty-eight ENDOPORE® dental implants were placed in the posterior mandible of 24 partially edentulous patients. Seventeen of these implants replaced premolar teeth while 31 replaced molars. Only 7mm and 9mm implants were used, and the majority (83%) of prosthetic restorations were single crowns. After a mean functional time of 32.6 months (range, 8. to 50.3), the implant survival rate was 100% and assessment of available data showed minimal to no crestal bone loss.

Inter J Oral Maxillofac Impls. 2001:16:653-658 @

49 A possible “rescue” procedure for dental implants with a textured surface geometry

Deporter, D.A.

Dental implants with textured surfaces are a valuable adjunct in restoring edentulous sites of poor bone quality and quantity, but on occasion may become denuded of bone and require “rescue”. We report here the successful management of infrabony crater affecting a single porous-surfaces dental implant using a combination of citric acid decontamination and grafting with freeze-dried, demineralized allograft covered with a barrier of calcium sulfate.


1. Porous-Surfaced Dental Implants Placed in Grafted Sinuses with Irradiated Bone and And Platelet Rich Plasma

Farsirotu, Sorin

This article presents a step-by-step technique for maxillary sinus grafting and pre-maxillary ridge augmentation followed by the placement of implants for fixed restorations. It points out the authors preferences based on the latest available research data regarding grafting material, platelet rich plasma used as a reservoir of bone growth factors, vomer bone anchorage for particulate bone graft stabilization, implant systems and types of fixed prosthesis.
2. Porous-Surfaced Dental Implants in the Partially Edentulous Maxilla: Assessment for Subclinical Mobility

Deporter, Douglas, DDS, PhD*, Todescan, Reynaldo, DDS, PhD**, Riley, Nicole, MSc***

Fifty patients received 151 short, porous-surfaced implants in the partially edentulous maxilla. Periotest values (PTV) were recorded at baseline and after 6 months, 1 Year and 2 years. For this, prostheses were removed and a standard abutment attached and tightened (20-Ncm force) to each implant. Data analysis indicated significant relationships between time and function vs. PTV and implant diameter (3.5, 4.1 or 5.0mm) vs. PTV. There was no relationship between PTV and implant length. PTV’s were more favorable in the posterior than the anterior maxilla, and better PTV’s were obtained with non-splintered as opposed to splinted implants.


3. Ten-Year Results of a Prospective Study Using Porous-Surfaced Dental Implants and a Mandibular Overdenture

D.A.Deporter, Philip Watson, Michael Pharoah, Reynaldo Todescan, George Tomlinson

**Background:** Numerous investigators have used osseointegrated dental implants as retention for Mandibular overdentures, but few have reported 10-year outcomes or incorporated carefully standardized radiographs to document crestal bone loss.

**Purpose:** The purpose of this study was to use a prospective clinical trial design to assess the performance of short sintered porous-surfaced dental implants with a mandibular complete overdenture when all patients in the trial had undergone 10 years of continuous function.

**Materials and Methods:** Fifty-two fully edentulous patients, most with advanced alveolar ridge resorption, each received three free-standing Endopore® implants (7-10 mm in length, mean length, 8.7 mm; Innova Corporation, Toronto, ON, Canada) in the mandibular symphysis region. After 10 weeks of submerged healing, these implants were used to support an overdenture. Carefully standardized radiographs, using a customized stainless steel filmholder attached to each implant and the x-ray tube, were collected at baseline, 3 months, 6 months, yearly to 5 years and then again at 7 and 10 years.

**Results:** Life table analysis revealed a 10-year implant survival of 92.7% and a mean annual bone loss after year 1 of 0.03 mm.

**Conclusions:** Short free-standing dental implants with a sintered porous surface used for implant fixation are a predictable and effective means of retaining a mandibular overdenture in patients with advanced mandibular ridge resorption.

*Clinical Implant Dentistry and Related Research 2002:4:4:1-7* @

4. Implantes de superficie porosa sinterizada: Aprovechamiento de ventajas clínicas únicas.

Deporter, D.A., Todescan, R., Campelo, L. Domínguez, Pilliar, R.M.
Los implantes dentales de superficie porosa sinterizada parecen ofrecer una serie de ventajas clínicas que permiten al implantólogo tratar a pacientes donde se presentaba un mayor riesgo de fracaso con sistemas de implantes dentales precedentes. Primordialmente, los implantes de superficie porosa sinterizada pueden ser utilizados de forma rutinaria con zonas con escasa disponibilidad ósea (7 mm o menos) dado que su interfase con el hueso consiste en un anclaje mecánico tridimensional por crecimiento del hueso dentro de la superficie porosa sinterizada. Otras ventajas incluyen: alto porcentaje de éxito en hueso de baja densidad tipo III o IV (esta superficie es más afín al hueso trabecular en vez de hueso cortical), formento de una respuesta de reparación ósea inicial más rápida, ausencia de necesidad de ferulización de las unidades protésicas (haciendo el procedimiento protésico más simple), menor preocupación por el tradicional ratio “corona-raíz”, y un patrón predecible de remodelación ósea crestal. Todas estas afirmaciones serán soportadas con la evidencia de estudios clínicos prospectivos en humanos e investigación animal.

*Periodoncia* 2002:6:369-382


Deporter, D.A., Todescan, R., Pilliar, R.M., Cooper, C.D.

This paper gives an overview, supported by ongoing clinical trial data, of the clinical advantages of a sintered porous-surfaced dental implant. These implants became integrated by bone ingrowth and resulting 3-dimensional mechanical interlocking at the bone-to-implant interface provides superior resistance to all components of force (tensile, torsional and compressive) received during occlusal loading. As a result, such implants can be routinely used in short lengths (7mm or less), do not require splinting of adjacent implants used to support prosthetic units, and are not negatively affected by poor “crown-to-root-ratio”. As well, since the porous surface prefers vascular bone, these implants appear to be well suited for use in sites where more traditional dental implant designs have proven unsatisfactory.

*Int Magazine Oral Implantology* 2003; p 53-58. @

6. *Effect of Surface Chemistry on the Rate of Osseointegration of Sintered Porous-Surfaced Ti-6Al-4V Implants*

Taché, Alex, Gan, Lu, Deporter, Douglas, Pilliar, Robert M.

**Purpose:** The effect of adding a thin sol-gel-formed calcium phosphate (CaP) coating to sintered porous-surfaced titanium alloy (Ti-6Al-4V) implants on rates of initial bone ingrowth was investigated.

**Materials and Methods:** Control implants (as manufactured) and similar implants with sol-gel CaP coatings were randomly placed in distal femoral rabbit condyles (1 implant/leg). After healing for 6, 9, 12, and 16 days, 8 of 10 rabbits in each time group were assessed for maximum implant pullout force (N) and interface stiffness (N/mm). Selected extracted implants also were examined by secondary electron imaging to characterize affected
surfaces. The implants of the remaining 2 rabbits in each group were examined by backscattered scanning electron microscopy (BSEM).

**Results:** Significantly greater pullout forces and interface stiffness were found for CaP-coated implants at 6 and 9 days. At 6 days, BSEM revealed bone ingrowth on CaP-coated implants but not on control implants. Secondary electron imaging and BSEM observations also suggested greater bone ingrowth with CaP-coated porous implants at 9, 12, and 16 days.

**Discussion:** Sol-gel-formed CaP surface films significantly enhance rates of bone ingrowth into sintered porous-surfaced implants.

**Conclusion:** This surface treatment may have a number of clinical benefits, including shortening the period prior to functional loading of such implants and improving treatment outcomes in situations of poor bone quality and/or quantity. (More than 50 references)


**7. A Targeted Review of Study Outcomes With Short (≤7mm) Endosseous Dental Implants Placed in Partially Edentulous Patients**

Hagi, D., Deporter, D.A., Pilliar, R.M., Arenovich, T.

**Background:** Generally, threaded root-form endosseous dental implants are thought to perform poorly in short lengths (i.e., <10 mm). However, whether modifications in implant surface geometry will improve performance of short threaded implants is less clear.

**Methods:** The relationship between dental implant failure rates and their surface geometry, length, and location (maxilla versus mandible) was explored in the published literature. Using a MEDLINE search (1985 through 2001), studies were sought with the following criteria: 1) data suitable to calculate failure rates of implant lengths ≤7mm versus >7mm; 2) data separable into maxillary versus mandibular results; 3) criteria for “failure” clearly defined; and 4) minimal functional period of 2 years.

**Results:** Twelve papers were identified as follows: eight with machined threaded implants, two with acid-treated threaded implants, and two with sintered porous-surfaced press-fit implants. The following results were found: 1) machined surface implants experienced greater failure rates than textured surface implants; 2) with the exception of sintered porous-surfaced implants, 7 mm long dental implants appear to have higher failure rates than those >7 mm length; and 3) with textured surface implants, higher failure rates were more likely in the maxilla than in the mandible, but with machined surface implants there were no differences in failure rates between maxilla and mandible.

**Conclusions:** Dental implant surface geometry is a major determinant in how well these implants perform in short lengths, defined here as lengths of ≤7 mm. While threaded implants show higher failure rates in short versus longer lengths, sintered porous-surfaced implants perform well in the defined “short” lengths. More studies are needed to better assess the performance of short, acid-washed threaded implants.

*J Periodontol 2004; Vol 75, p798-804. @*

**8. An Assessment of Crown-to-Root Ratios With Short Sintered Porous-Surfaced Implants Supporting Prostheses in Partially Edentulous Patients.**

Shahin Rokni, DDS¹/Reynaldo Todescan, DDS PhD²/Philip Watson, DDS, MScD²/
Purpose: Implant length, implant surface area, and crown-to-implant (c/i) ratio and their relationship to crestal bone levels were analyzed in 2 groups of partially edentulous patients treated with sintered porous-surfaced dental implants. Materials and Methods: One hundred ninety-nine implants were used to restore 74 partially edentulous patients with fixed prostheses. Implants were categorized according to their length (“short” versus “long”) and estimated surface area (“small” versus “large”). “Short” implants had lengths of 5 or 7 mm, while “long” implants were either 9 or 12 mm in length. “Small” implants had estimated surface areas of < 600 mm², while “large” implants had estimated surface areas > 600 mm². Other data collected included c/i ratio (measured on articulated diagnostic casts), whether or not the implants were splinted, and standardized sequential radiographs. Results: The mean c/i ratio was 1.5 (SD = 0.4; range 0.8 to 3.0), with 78.9% of the implants having a c/i ratio between 1.1 or 2.0. Neither c/i nor estimated implant surface area (small or large) affected steady-state crestal bone levels. However, implant length and whether the implants were splinted did appear to affect bone levels. Long implants had greater crestal bone loss (0.2 mm more) than nonsplinted ones. These differences were statistically significant. Discussions and Conclusions: Sintered porous-surfaced implants performed well in short lengths (7 mm or less) in this series of partially edentulous patients. The data suggested that long implant lengths and/or splinting can result in greater crestal bone loss; longer implants and splinted implants appeared to favor greater crestal bone loss in this investigation. These conclusions are of course specific to the implants used and would not be relevant to other implant types.

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9. What physical and/or biochemical characteristics of roughened endosseous implant surfaces particularly enhance their bone-implant contact capability?

Douglas Deporter, DDS, PhD

Implant surface “roughness” (texture) and/or chemistry primarily will affect (by promoting osteoconduction) the rate of formation and extent of initial bone-to-implant contact, ie, the initial Osseointegration process. Compared to machined surfaces, rough (eg, acid-washed, particle-plasted, titanium plasma-sprayed [TPS]) textures created on threaded implants promote more extensive activation of platelets (with associated release of growth factors) and the rapid formation of a “cell migration template” of fibrin fibrils tangentially oriented in the initial blood clot. All of these early events in wound healing promote directional migration and activation of osteoprogenitor cells and subsequent contact osteogenesis by these cells at the implant surface. As a result, rough-textured threaded implants seem to require shorter initial healing times and may be more suitable for the greater challenges of immediate implant loading than machined threaded implants. Sintered porous surfaces (generally used on nonthreaded, press-fit implants) behave similarly, with even faster bone formation (likely caused by more extensive fibrin fibril attachment, greater early interfacial tissue stiffness, and a more favourable response by osteoprogenitors to local distortional tissue strain acting within the pores) compared, for example, to TPS-coated surfaces.


10. Further Data on the Predictability of the Indirect Sinus Elevation Procedure Used with Short, Sintered, Porous-Surfaced Dental Implants

Douglas Deporter, DDS, PhD/Suzanne Caudry, DDS, MSc/Jaffer Kermalli/Albert Adegbembo, PhD.

The object of this report was to provide further data supporting the use of short (primarily 7-mm-long) dental implants with a sintered, porous surface geometry to treat the posterior maxilla using the indirect, osteotome-mediated, localized sinus elevation procedure. Records were available for 104 Endopore implants (Innova)(the majority being 7 mm in length) in 70 patients, and the majority of implants had been placed in the location of the maxillary first molar. The mean initial subantral bone height before implant placement was 4.2 mm, with a range of 2 to 6.7 mm, and all implants were placed using hand osteotomes and a graft of bovine hydroxyapatite. After an average time in function of 3.14 years, only two implants had been lost, both as a result of unusual circumstances. It is concluded that the use of short, sintered, porous-surfaced implants and localized indirect sinus elevation is a predictable and minimally invasive approach to manage the posterior maxilla with minimal preoperative subantral bone height.


Douglas Deporter, DDS, PhD.

Recent advances in technique have led to the simplification of the restoration of the resorbed posterior maxilla with dental implant-supported prostheses. While direct open window sinus elevations to access the sinus cavity continue to be used (particularly when multiple implant sites in a single sextant require sinus augmentation), many patients with minimal subantral bone height can be more easily and less expensively managed with the indirect sinus elevation approach. Ongoing data collection for the implant placement technique described in this article confirms that the combination of short, sintered porous-surfaced dental implants and the indirect, osteotome-mediated, localized sinus elevation procedure is a highly predictable, minimally invasive mode to address the restoration of the resorbed posterior maxilla with implant-supported fixed partial prostheses. The procedure can be performed with predictable success in sites with ≥3 mm of original subantral bone and appropriate alveolar ridge width.

Inside Dentistry. March 2006

12. Heterotopic bone formation around sintered porous-surfaced Ti-6Al-4V implants coated with native bone morphogenetic proteins

Z Simon, DA Deporter, RM Pilliar, and CM Clokie

PURPOSE: Coating endosseous dental implants with growth factors such as bone morphogenetic proteins (BMPs) may be one way to accelerate and/or enhance the quality of osseointegration. The purpose of this study was to investigate in the murine muscle pouch model whether sintered porous-surfaced titanium alloy implants coated with BMPs would lead to heterotopic bone formation around and within the implant surface geometry.

MATERIALS: Porous-surfaced dental implants were coated with partially purified native human BMPs, with or without a carrier of Poloxamer 407 (BASF Corp., Parsippany, NJ), placed in gelatin capsules and implanted into the hindquarter muscles of mice. Mice were euthanized after 28 days. Sections of retrieved specimens were subsequently prepared for morphometric analysis of bone formation using backscatter electron microscopic images.

RESULTS: Human BMPs, either with or without the carrier of Poloxamer 407, led to bone formation within and outside of the sintered porous implant surface. When the sintered implant surface region was subdivided into inner and outer halves, similar levels of bone ingrowth and contact were seen in the 2 halves. Evidence of bone formation to the depth of the solid implant core (i.e., the deepest level possible) also was seen. DISCUSSION AND CONCLUSIONS: Sintered porous-surfaced dental implants can be used as substrate for partially purified BMPs in the murine muscle pouch model. With the addition of these osteoinductive factors, the porous implant surface supported bone formation within the surface porosity provided, in some instances, all the way to the solid implant core. The addition of growth factors to a sintered porous surface may be an efficient method for altering locally the healing sequence and quality of bone associated with osseointegration of bone-interfacing implants.

13. Threaded versus porous-surfaced implants as anchorage units for orthodontic treatment: three-dimensional finite element analysis of peri-implant bone tissue stresses

RM Pilliar, G Sagals, SA Meguid, R Oyonarte, and DA Deporter

PURPOSE: A 3-dimensional finite element model was developed to investigate the cause of different crestal bone loss patterns observed around sintered porous-surfaced and machined (turned) threaded dental implants used for orthodontic anchorage in a previously reported animal study. MATERIALS AND METHODS: Twenty-noded structural solid elements with parabolic interpolation between nodes were used for modeling the bone-implant interface zone. A 3-N traction force acting between either 2 porous-surfaced or 2 machined threaded implants placed in canine premolar mandibular sites and bone profiles observed at initiation and 22 weeks of orthodontic loading were modeled. RESULTS: Higher maximum stresses in peri-implant bone next to the coronal region of the implants were predicted with the machined threaded implants at both the initial and final time points, with the values 20% greater than those predicted after the 22-week loading period. These values were approximately 200% greater than those predicted for the porous-surfaced implants, for which a more uniform stress distribution was predicted. DISCUSSION: The finite element model results indicated that the observed greater retention of crestal bone next to the porous-surfaced implants was attributable to lower peak stresses developing in crestal peri-implant bone with this design, which decreased the probability of bone loss related to local overstressing and bone microfracture. CONCLUSION: The predicted lower stresses were a result of the more uniform transfer of force from implant to bone with the porous-surfaced implants, which was a consequence of the interlocking of bone and implant possible with this design.


E Shimada, RM Pilliar, DA Deporter, R Schroering, and E Atenafu

PURPOSE: The purpose of this study was to compare patterns of crestal bone remodeling with 2 sintered porous-surfaced dental implant designs during a 14-month functional period. MATERIALS AND METHODS: Two root-form press-fit dental implants were evaluated in healed extraction sites in dog mandibles. The standard (control) design was a press-fit implant with a 2-mm machined collar; the remainder of the implant had a sintered porous surface. The test or "hybrid" design had 3 coronal machined threads instead of a machined collar; the remainder of the implant had a sintered porous surface. RESULTS: Standardized radiographs indicated significantly less crestal bone loss (0.82 to 0.93 mm versus 1.45 to 1.5 mm) with the hybrid design and a slower approach toward an apparent steady state (12 to 14 months for the hybrid versus 7 months for the standard design). Morphometric assessment of back-scattered scanning electron micrographs confirmed that crestal bone loss was significantly less for the hybrid design on all but the lingual implant aspect. CONCLUSION: The addition of coronal threads to an implant relying on a sintered porous surface geometry for its long-term osseointegration reduced the extent of crestal bone loss compared to a machined collar region.
64. **Performance of Threaded Versus Sintered Porous-Surfaced Dental Implants Using Open Window or Indirect Osteotome-Mediated Sinus Elevation: A Retrospective Report**

Jaffer Y. Kermalli, Douglas Deporter, Jim Y. Lai, Ernest Lam, Eshetu

**Background:** The purpose of this retrospective report was to evaluate the performance of dental implants placed in a teaching environment in patients requiring maxillary sinus elevation.

**Methods:** Threaded (acid washed or sand blasted acid etched) and sintered porous surfaced (SPS) press fit implants were used. Sinuses were managed using direct (open window) or indirect (osteotome-mediated) techniques. Records were available for 97 implants in 62 patients. Preoperative subantral bone heights were determined from radiographs, primarily panoramic. Of 69 threaded implants used, 40 and 29 were placed using direct (DTH) and indirect (ITH) techniques, respectively. Twenty-eight SPS implants were placed using the indirect technique. Implant failure rates using the Kaplan-Meier method of analysis and cumulative crestal bone loss (the latter based on bone levels seen in the most recent radiographs) were determined for both types of implants.

**Results:** The mean preoperative subantral bone height for DTH implants was 5.0 mm (range, 1 to 12 mm). Preoperative bone heights for ITH implants and SPS implants placed using the indirect approach were 7.2 mm (range, 4 to 12 mm) and 4.2 mm (range, 3 to 6 mm), respectively. Significant differences in preoperative bone height were seen between DTH and ITH implants (P < 0.0001) and between ITH and SPS implants (P < 0.0001). Average functional times were 18.7 months and 16.3 months for DTH and ITH implants, respectively, whereas the average functional time for SPS implants was 49.9 months. Time in function was significantly greater (P < 0.0001) for SPS than DTH and ITH implants. Significant differences in implant length were also seen, with SPS implants significantly shorter than DTH or ITH implants. Three implants failed to integrate, one in each of the three treatment groups, giving initial survival rates of 97.5%, 96.6%, and 96.4% for DTH, ITH, and SPS implants, respectively. Mean cumulative crestal bone loss measurements were 1.84, 1.90, and 0.57 mm for DTH, ITH, and SPS implants, respectively. Bone loss was significantly less with SPS implants than with DTH or ITH implants. A second SPS implant failed after 7 years in function, likely because of prosthetic deficiencies. This late failure reduced the Kaplan-Meier survival rate to 80.4% for the SPS group.

**Conclusion:** Results from this teaching clinic suggest that the use of dental implants with sinus elevation procedures is a predictable treatment for the resorbed posterior maxilla.

65. **Ultrashort Sintered Porous-Surfaced Dental Implants Used To Replace Posterior Teeth**

Douglas Deporter, Bunai Ogiso, Dong-Seok Sohn, Kevin Ruljancich, Michael Pharoah

**Background:** This retrospective multicenter report provides data from a case series of partially edentulous subjects treated with an ultrashort (5mm long) sintered porous-surfaced (SPS) dental implant.

**Methods:** The implant used had a tapered truncated cone shape, was 5mm long, and had a maximal coronal diameter of 5 mm. Twenty-six implants were placed in 20 subjects to replace primarily maxillary and mandibular molar teeth. Submerged primary healing was used. Nine implants were restored with single crowns, one carried a single cantilever, and the remaining 16 implants were part of fixed implant-supported bridges, generally as the most distal abutment.

**Results:** After functional periods of 1 to 8 years, two maxillary implants failed, giving maxillary and mandibular failure rates of 14.3 % and 0% respectively.

**Conclusion:** The results of this case series suggest that an SPS, press-fit, tapered dental implant with a length of 5 mm and a maximal coronal diameter of 5 mm should be investigated further as a solution for the management of highly resorbed posterior sites in partial edentulism, particularly in the mandible.


66. **“Biologic Width” and Crestal Bone Remodeling with Sintered Porous-Surfaced Dental Implants: A Study in Dogs**

Douglas Deporter DDS, PhD, Arwa Al-Sayyed DDS, MSc, Robert M. Pilliar BSc, PhD, Nancy Valiquette, BSc

**Purpose:** The aim of this study was to obtain histometric measurements of bone and peri-implant mucosal tissue contact with implants of 2 sintered porous-surfaced designs. The “short-collar” design had a collar height (smooth coronal region) of 0.75 mm, while the “long-collar” model had a smooth coronal region of 1.8 mm.

**Materials and Methods:** Implants (2 per side) were placed in healed mandibular extraction sites of 4 beagle dogs using a submerged technique. After 4 weeks of healing, they were uncovered and used to support fixed partial dentures for a 9-month period. After sacrifice, specimens were retrieved and nondemineralized sections were examined histometrically to determine the most coronal bone-to-implant contact (first BIC) using the microgap as a reference and standard mucosal parameters of “biologic width.”

**Results:** Significant (P = .001) differences in first BIC were found between designs (1.97 mm for long-collar versus 1.16 mm for short-collar implants) for posteriorly located implants but not for anteriorly located ones (1.21 mm versus 1.38 mm; P = .40). If crestal bone loss involved sintered surface, fibrous connective tissue ingrowth was observed to replace lost bone. No significant differences in peri-implant mucosal measurements (total peri-implant mucosal thickness; length of the epithelial component of this mucosa, and thickness of the connective tissue component) were detected between implant designs.
Conclusions: Results suggest that “biologic width” accommodation drives initial crestal bone loss with sintered porous-surfaced implants. Histometric data obtained for bone contact showed no significant differences between the long- and short-collar implant designs.


67. Utilizzo di impianti corti nelle riabilitazioni dei settori posteriori : risultati preliminari

Lombardo G, Corrocher G, Russo A, Trevisiol L, Urbani U, Nocini PF

Scopo di questo lavoro è stato quello di valutare la stabilità al momento del posizionamento delle viti di guarigione di impianti a superficie sinterizzata di dimensioni pari a 5×5 mm. Allo studio hanno partecipato 20 pazienti di età compresa tra i 40 e i 70 anni, parzialmente edentuli nei settori laterali della mandibola e/o del mascellare superiore. Le aree edentule dovevano presentare un grave riassorbimento osseo in senso verticale cosicché la mandibola doveva presentare uno spessore osseo \( \geq 6 \) mm e una distanza tra la cresta ossea e nervo alveolare (AC-NAI) \( \leq 7 \) mm, e il mascellare superiore una distanza tra il margine crestale e il pavimento del seno mascellare (AC-SF) compresa tra 3 mm – 6 mm. Gli impianti utilizzati nel nostro studio sono stati gli Endopore Dental System a superficie porosa sinterizzata di diametro pari a 5 mm e lunghezza pari a 5 mm con 1 mm di collare macchinato liscio, di forma tronco-conica con un design che ne permette l’inserimento a pressione ad esagono esterno. Nel corso di questo studio sono stati inseriti complessivamente 32 impianti di cui, 16 nel mascellare superiore (8 con la tecnica di compattazione laterale mediante osteotomi e 8 impianti nel mascellare superiore per mezzo di osteotomi secondo la tecnica di minirialzo del seno mascellare secondo Summers) e 16 nella mandibola per mezzo di frese. Al momento della vite di guarigione, è stato valutato il valore di stabilità implantare attraverso l’analisi della frequenza di risonanza (RFA) con l’apparecchiatura Osstell. Dai valori di stabilità ottenuti abbiamo potuto concludere che questo particolare tipo di impianti sembra essere in grado di fornire al momento del rientro chirurgico ottimi livelli di osteointegrazione sia nel mascellare che nella mandibola. In situazioni di estremo riassorbimento crestale dove è stato necessario eseguire consensualmente al posizionamento dell’impianto, un mini rialzo di seno, i livelli di stabilità implantare hanno dimostrato delle forti oscillazioni da caso a caso, per cui il grado di affidabilità di questo tipo di soluzione resta ancora incerto.

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68. Short Porous Implants in the Posterior Maxilla: A 3-year Report of a Prospective Study

G. Corrente, R. Abundo, A. Bermond des Ambrois, L. Savio, M. Perelli.

The aim of this ongoing prospective study was to determine the 36-month survival rate of short porous implants in the posterior maxilla with 2 to 7 mm of initial bone height in 48 patients. Forty-eight implants were placed; 35 were in sites with a bone height of 5 mm or less and 13 patients required sinus elevation with osteotomes in addition to a xenograft. All implants were loaded with single crowns. At the end of the follow-up period the survival rate was 97.92%. The use of short porous implants showed good predictability in the treatment of posterior maxilla in this interim 3-year report.

69. Use of Sintered Porous-Surfaced Dental Implants to Restore Single Teeth in the Maxilla: A 7- to 9-Year Follow-up

Kevin MacDonald, DDS, MSc / Michael Pharoah, DDS, MSc / Reynaldo Todescan, DDS, PhD / Douglas Deporter, DDS, PhD

This report from a prospective study discusses the status of a group of 20 single maxillary sintered porous-surfaced (SPS) dental implants after 7 to 9 years in function restored with screw-retained crowns. Twenty patients each received a single SPS implant placed in a two-stage surgical approach; 65% replaced a premolar or molar teeth, while the remainder replaced anterior teeth. Patients were examined annually. Standardized radiographs were used to assess peri-implant crestal bone levels and to determine and to determine an implant success rate. Jemt Papilla Index scores were used to assess the extent of papilla reformation between each implant and its two contiguous teeth. After 7 to 9 years, 17 implants were available for assessment (one patient had died, and two patients had moved away). One implant was removed after the 9-year visit because of progressive bone loss, giving a survival rate of 92.9%. The failure of this implant was related to deficiency in initial alveolar ridge width with loss of the remaining thin buccal cortical plate. With the exception of the failed implant, no significant changes in mean annual crestal bone loss were noted from years 1 to 9, giving a similar success rate (92.9%). Jemt Papilla Index scores of 2 or 3 were assigned for the majority of papillae. SPS implants can be used effectively to replace single missing maxillary teeth.


70. Short Sintered Porous-Surfaced Dental Implants with Indirect Sinus Elevation to Restore the Resorbed Posterior Maxilla

Douglas Deporter, DDS, PhD

Using short sintered porous-surfaced dental implants with the indirect sinus elevation procedure is a minimally invasive approach to replacing teeth in the resorbed posterior maxilla. 7mm long implants may be used at sites with as little as 3mm of original subantral bone height with predictable success if certain principles are recognized and followed. In this short paper, the author reviews the rationale, techniques used, and long term patient outcomes with this innovative approach.

71. A case of rapidly progressive peri-implantitis around a short sintered porous-surfaced implant

Malchiodi L., Cucchi A., Ghensi P., Bondi V.

The aim of this case report is to show a rapidly progressive form of peri-implantitis around a 7mm-long sintered porous-surfaced (SPS) implant. It was actually characterized by extremely rapid progression of bone loss, which led to the failure of one implant in about 60 days. Although surgical treatments were attempted to arrest bone resorption, peri-implantitis did not resolve. Short implants are a very useful solution for the management of highly-resorbed posterior areas, that is why patients who rehabilitated with these kinds of implants should adhere to a well-established oral hygiene protocol to prevent bone resorption, which could compromise long-term survival of short implants.

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72. Impianti ultracorti a superficie sinterizzata: analisi della stabilità dell’osso crestale a distanza di 2 anni dal carico
Lombardo G., Corrocher G., Trevisiol L., Fiorino A., Bondi V., Nocini P. F.

Obiettivi: lo scopo di questo lavoro è quello di valutare, a distanza media di 2 anni dal carico protesico, la percentuale di sopravvivenza e la stabilità dei tessuti periimplantari di impianti ultra corti (5x5 mm) a superficie porosa sinterizzata in pazienti con creste edentule fortemente atrofiche. Materiali e metodi: nel corso di questo studio sono stati inseriti, in 20 pazienti di età compresa tra i 40 e i 70 anni, complessivamente 32 impianti con superficie porosa sinterizzata di forma tronco-conica di dimensioni pari a 5 mm di diametro per 5 mm di lunghezza. È stata quindi valutata la percentuale di sopravvivenza e la perdita ossea periimplantare mesiale e distale mediante indagine radiografica al momento del posizionamento degli impianti (T0), al momento della protesizzazione (T1) e al controllo dopo circa 2 anni dal carico protesico (T2). Risultati: la percentuale di successo cumulativa a distanza di 24,3 ± 3,12 mesi di carico è stata pari al 93,75%. Per quanto riguarda gli impianti posizionati nella mandibola e nel mascellare rispettivamente con le frese e con la condensazione laterale la percentuale di successo è stata pari al 100%, mentre, nel mascellare superiore in presenza di spessori ossei inferiori ai 5 mm, utilizzando la tecnica del minirialzo la percentuale di sopravvivenza è stata dell’87,5%. Conclusioni: l’analisi dei risultati da noi ottenuti e il confronto con quelli riportati in Letteratura ci permette di auspicare, per questa tipologia d’impianti, ulteriori e più approfonditi studi, caratterizzati da periodi di follow-up più lunghi, che permettano una migliore valutazione di quali siano le effettive potenzialità d’impiego di questo tipo di impianti nelle riabilitazioni di mascellari gravemente atrofici.

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