

PROSTHODONTIC

Insights

A Digest of Recent Trends, Techniques and Clinical Concepts of Dental and Facial Esthetics

The Long-Term Efficacy of Currently Used Dental Implants: A Review and Proposed Criteria of Success

The reported method of osseointegration is a viable analogue for the long-term attachment mechanism of a dental implant. Branemark has pioneered a new system of implant biotechnology and provided clinicians and researchers alike with a compelling yardstick for determining implant success. This yardstick, quite logically, dismisses the originally proposed criteria from the 1979 NIH publication,* and demands stricter expectations from the dental profession prescribing an implant method. Both the NIH minimal criteria (for historical and comparative pur-

poses) and the newly proposed criteria are graphically listed in the table on page 4. These are relatively easy to apply, and above all ensure a degree of clinical success that is comparable with that experience in conventional prosthodontic therapy. They are also reconcilable with certain clinical and laboratory observations:

1. *Osseointegration is a histological definition, and only partially a clinical and radiographic one. An implant can only be judged as osseointegrated in the context*

(continued on page 4)



Osseointegration: The State of Research

by Thomas J. Balshi, D.D.S., F.A.C.P.

Dental medicine continues to progress and change at an accelerating rate. Each month thousands of manuscripts covering new procedures in all fields of dentistry go gently thudding onto the desks of medical editors and publishers.

The field of prosthodontics is not immune to this "information overload." An aging population base is encouraging wide-ranging research into new and better ways to improve the esthetics, health, and functioning of the oral cavity.

Prosthodontic Insights will attempt to help provide information on innovations in prosthodontics and other dental specialties through a periodic update of timely and important articles in the field, abstracted for convenient reading.

Our premier issue focuses on osseointegration. While osseointegration is not new—the research having begun over thirty years ago in Sweden by Dr. Branemark—the use of titanium fixtures to support fixed bridges has seen rapid growth domestically, so much so it is almost becoming a sub-specialty of prosthodontics unto itself.

As an example, the Academy of

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Review of New Rare Earth Magnetic Technology

Permanent magnets have been experimented with as retention aids in dental prosthetics as early as the 1930s. The techniques tried in earlier years failed to show much clinical merit and have fallen into disuse. One reason was that conventional magnetic alloys were not strong enough to produce retention of a prosthesis at an acceptable level. Recent developments in the field of permanent magnetic alloys have rekindled use of magnetic retention for dental prosthetics.

Development of rare earth alloys

In 1967 a new class of permanent magnetic alloy was developed by Joseph Becker of General Electric Research Laboratory and Gary Hoffer of the Air Force Materials Laboratory. When transition elements (Cobalt or Iron) were alloyed with the Lanthanum Series (Rare Earth elements), permanent magnets could be produced which were extremely resistant to being demagnetized. For this reason, the magnet may be miniaturized without losing its magnetic retention.

are Earth magnets have strengths twenty to fifty times greater per unit volume than the strongest Ferrite or Alnico magnets.)

Due to the recent development of ioniza-

tion column separation techniques, Rare Earth elements can now be economically produced.

Open-field attachments

The Japanese were the first to utilize Rare Earth magnets in an open flux field system to increase retention of dental prosthetics. Magnets or steel plates were embedded into decoronated root structures and like magnets were cured into the denture base so that the attractive force would unite the prosthesis. The system however, was bulky and inefficient and fell below the 400 gram minimum attractive force suggested by Lehmann and Arnim.

The Dyna Magnet

The Dyna Magnet is one such commercially available "open field" attachment. The disadvantage of open field systems is that they only utilize one pole of the magnet, and as a result, the magnetic flux field from the other pole radiates into the surrounding tissue—which has been questioned as to its long-term effects. For these reasons, the use of open field magnets for permanent intraoral use is discouraged.

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Abstracts from the 10th Annual Conference of the European Prosthodontic Association*

Tissue-Integrated Prostheses in Oral and Maxillofacial Rehabilitation

Branemark, P.-I., The Institute for Applied Biotechnology, Gothenburg, Sweden

Tissue-integrated prostheses offer a new treatment modality for patients whose structural or functional defect cannot be adequately compensated for by conventional prosthetic appliances. Based on osseointegrated anchorage elements of pure titanium, long-term clinical results in multicenter studies have demonstrated the efficacy and safety of this therapeutic approach without

any significant side effects.

It seems reasonable to assume that lifelong stability of the prosthesis can be provided in cases of complete or partial edentulism including single tooth replacement. Even in cases of extreme jaw bone resorption or discontinuous skeleton, rehabilitation can be achieved, sometimes requiring bone grafting.

Similar methods have been used to provide attachment of craniofacial prostheses.

The basic concept of tissue integration will be described and discussed with respect to cost benefit, cost efficiency aspects related to clinical results, and hard- and soft-tissue conditions based on objective criteria of success and failure.

The necessity of continued development of material and methods for prosthetic components to be attached to osseointegrated elements will be discussed, and the importance of presurgical prosthetic planning will be emphasized.

The Hopeless Periodontal Condition Treated with Osseointegration

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The treatment of periodontally compromised dentition using osseointegration may be categorized in three major therapeutic classifications. These are:

I. The traditional Branemark method of T.I.P. replacing all periodontal hopeless teeth. This method relies on the patient's ability to cope with a complete removable denture during the preliminary and intermediary stages of treatment.

II. The Class II Modification of the Branemark method is to stabilize periodontally compromised and mobile teeth through splinting to osseointegrated Biotes fixtures.

III. The Class III method is the complete replacement of the periodontally hopeless dentition with an osseointegrated prosthesis without rendering the patient totally edentulous prior to the delivery of the tissue-integrated prosthesis. Using this method, the patient is at no time required to wear a removable prosthesis.

The sequential Tentative Treatment Plan is essential to coordinate treatment. It consists of four phases:

Phase I. Preliminary Treatment—consists of pre-surgical prosthodontic treatment, initial periodontal therapy, endodontic treatment, and the removal of periodontally hopeless teeth.

Phase II. Re-evaluation—includes fixture installation.

Phase III. Final Restoration—devoted to fabrication and installation of the Tissue Integrated Prosthesis.

Phase IV. Maintenance and Disease Control—establishes a specific recall program and special plaque control instrumentation. Long-term observation and disease control are mandatory.

material is critical, and modifications such as reinforcing can be useful. Finally, the chemical structure and the nature of the additives are responsible for the aging behavior of the material.

In this work, a cyanoacrylate reinforced with PMMA beads was used as repair material. The flexural strength of the abc compound was examined compared to that of cyanoacrylate adhesive alone, and their behavior during an extended immersion into synthetic salivas (with different pH values, at 37°C, for several months) was also followed.

The measurements indicate that cyanoacrylate at first gives better results than the reinforced material; but after aging, the strength of the cyanoacrylate adhesive decreases more rapidly than that of the reinforced material. The pH value also has an important effect. At lower values (pH 5), the flexural strength decrease is greater, probably because of hydrolysis phenomena.

Reinforced Cyanoacrylates As Repair Materials

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The efficiency of a denture repair material cannot be estimated only by the adhesive bond to the poly(methyl methacrylate) (PMMA) substrate, but also by its flexural strength and resistance to aging. For the optimization of adhesive bond, the chemical nature and wetting ability of the repair material, as well as the surface treatment, are of primary importance. For the flexural strength, the mechanical behavior of the

The Prevalence of TMJ Dysfunction Among Complete Denture Wearers

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There is a controversy in regard to the appearance of TMJ dysfunction among complete denture wearers and to the factors which may be involved with its prevalence.

The aim of this study was to find out the prevalence of TMJ dysfunction among complete denture wearers, and the signifi-

*Conference held at the University of Oxford, England, September 3-5, 1986, and supported by the British Society for the Study of Prosthetic Dentistry and the Dental Materials Panel of the United Kingdom and the International College of Prosthodontists.

sis (Balshi—Conversion Prosthesis—*Quintessence International*, Vol. 16, No. 10).

The technique described in this article to make use of malpositioned dental implants consists of constructing a two-piece cast superstructure. The inferior portion of this superstructure is attached to the dental implants with screws. The superior portion of the superstructure carrying the dental components is oriented to the inferior portion by means of a keyway slot and attached to it with screws.

A simple approach is to incorporate the matrix of any preformed cast on a tube/screw system precision attachment. The matrix screw is later incorporated into the occlusal section to rigidly combine both sections and prevent horizontal movement. Vertical movement is restricted by the stabilizing lugs that also minimize stress on the vertical positioning screws. The vertical screws do not need to be parallel, and generally two are used, one on each side and posteriorly situated.

At the insertion appointment, microleakage is minimized by placement of a film of bacteriostatic silicone rubber luting agent between the two sections. This procedure has proven effective in controlling taste sensation and halitosis, which have on occasion been reported by some patients.

**Quintessence of Dental Technology*, September/October, 1987.

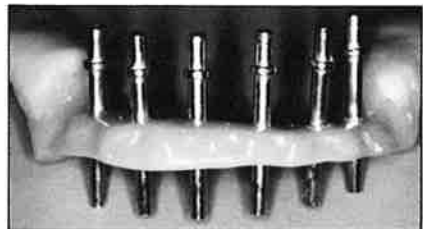
Surgical Guidestents for Placement of Implants

Thomas J. Balshi, D.D.S., F.A.C.P. and Don G. Garver, D.D.S., F.A.C.P.

Osseointegration of implants via the Branemark method, can provide a predictable prognosis for restoration, reconstruction, or rehabilitation of the fully or partially edentulous patient. However, one factor in the formula for successful osseointegration is fixture position. Successful abutment connection and uncomplicated prosthesis fabrication requires properly placed, spaced and aligned fixtures. This is achieved when screw access to the jawbone anchorage unit is positioned within the buccal-lingual confines of the maxillary and mandibular posterior artificial teeth or in the mandibular arch slightly lingual to the anterior replacement teeth. The use of surgical guidestents greatly enhances the surgeon's ability to quickly and accurately determine fixture location and long axis angulation.

There are **three basic surgical guidestents** useful in osseointegration.

1. Fully Edentulous Guidestent: There are two types of fully edentulous



guidestents: one provides a *general guide* to the area of fixture placement, and the second provides a *specific guide* to the location and angulation of each fixture to be placed. The general guidestent is constructed by duplicating the transitional denture.

The *specific guidestent* for the fully edentulous arch uses 2-mm diameter plastic tubes set in a duplicate of the transitional denture base.

2. Partially Edentulous: Removable Partial Denture Design: Specific location and angulation can be achieved by determining fixture location on the stone cast. This guidestent also incorporates the plastic guide tubes. In the maxilla, complete palatal coverage will help stabilize the guidestent. The denture supporting area is covered only to the facial-palatal width of the replacement teeth; it should not include the denture flange extension.

3. Partially Edentulous Tooth Supported Design: After abutment teeth are prepared, a diagnostic cast is made and a duplicate of the provisional fixed bridge is constructed containing the plastic guide tubes identifying fixture locations. The pontic areas are reduced occlusally so that only 3 mm of occlusal height remains above the area where the fixtures are to be installed.

Occasionally, the osseous anatomy envisioned on the diagnostic cast may not represent the true clinical condition when the soft tissue flap is reflected. In this instance the surgical guidestent may not permit the surgeon to center the fixture in the area of greatest bone volume. Free hand fixture placement is then carefully performed using the guidestent to provide the approximate location and interfixture space requirements. The surgeon must then use his clinical judgement for fixture angulation, based on his understanding of the prosthetic construction of the tissue integrated prosthesis.

**Journal of Oral Maxillofacial Surgery*, 45:463-465, 1987.

An Alternate Method for The Production of Accurate Casts And Occlusal Records in Osseointegrated Implant Rehabilitation

Patrick J. Henry, B.D.Sc., M.S.D.

This article describes a protocol for the fabrication of a correctable working cast that will ensure accuracy of fit of the superstructure in osseointegrated implant rehabilitation.

The fit of the final prosthesis can be no better than the accuracy of the impression.

Heavy-gauge, half-round wire is bent to fit the coping arrangement and united by using Duralay in bulk to ensure a rigid transfer complex. An elastomeric impression is then made to relate the transfer complex to the residual ridge and associated anatomic landmarks. The transfer complex is removed from the impression and is returned to the cast for verification of fit under the microscope. Discrepancy at

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The Imperfection of An Undisciplined Law

Charles L. Berman, D.D.S.

The advent of the commercialization of "osseointegration" has created a climate in which some manufacturers have promoted their products with little disclosure of pre-clinical testing. Some companies have emphasized advertising and superficial inducements to attract business.

Does this leave practitioners and patients at risk, and how is this possible when the F.D.A. licenses implantable devices for marketing?

Congress mandated Section 510(K) of the Federal Food and Cosmetic Act which only requires that an implantable device be "substantially equivalent" to one marketed in interstate commerce prior to May 28, 1976.

A manufacturer does not have to demonstrate safety or effectiveness under 510(K). It is also our understanding that they are not required to report to users component failures of 510(K) licensed products.

It appears that under 510(K), a household titanium nail would be marketable as an implant. In part, because of the undisciplined and unscientific nature of 510(K), The American Dental Association established its own evaluation program. To our knowledge, only one system (Biotes/The Nobelpharma System/Branemark) has been classified as provisionally acceptable. The question must be asked—were the non-ADA accredited systems adequately tested prior to marketing—and—to what extent have the companies reported component failure.

*Newsletter of the Academy of Osseointegration, New York, 1988. Reprinted with Dr. Berman's permission.

(Editorial note: The F.D.A. may soon implement a change in implant licensing with more stringent requirements.)

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the coping-abutment interface of the replica can occur because of faulty placement of the replica in the impression, vibration of stone or inadequate fit of components. Such discrepancy is corrected by partial sectioning of the cast and removal of the faulty abutment replica. An alternative replica can then be repositioned into the transfer complex and the cast accurately reconstituted by using a quick-setting mounting stone.

The precision of fit achieved with the double-check impression procedure ensures that the laboratory fit of the prosthesis superstructure will be identical with that in the mouth.

Trauma from occlusion and from unfavorable jaw relations can result in marginal bone loss. Therefore, precision recording of jaw movements is important in determining the optimum occlusal scheme to adequately distribute stress to the fixtures.

**Journal of Prosthetic Dentistry*, December, 1987, Vol. 58, No. 6.

The Role of the Speech Pathologist For the Patient Undergoing Osseointegration

Nancy F. Seidmon, M.A., C.C.C., Speech/Language Pathologist, Prosthodontics Intermedica



Over the years the speech pathologist has played an important role treating speech disorders related to the dentition. The family dentist, pedodontist and orthodontist will see children with articulation problems related to malocclusion, tongue thrust or missing teeth, which may temporarily offset speech.

With the advent of osseointegration, a new role has been defined for the speech pathologist. The oral cavity is undergoing dramatic and sometimes abrupt change. During this period of change it is important that compensating techniques be taught to the patient to maintain good speech habits.

Referring to the treatment phases (I-IV) outlined by Dr. Balshi in "The Hopeless Periodontal Condition Treated with Osseointegration" (*Prosthodontics Insights*, Vol. 1, No. 1), in Phase I, the removal of teeth can create potential changes in articulation that may become habitual if not attended to. This is generally, more applicable for missing maxillary incisors and canines than for bicuspid and molars, and is usually controlled via provisional restorations.

In phases II, III and IV lingual position and incisal edge length changes must be controlled to again, avoid changing speech habits.

For many patients these misarticulations may be temporary and will self-correct by the time the treatment process is complete. Other patients will need some

monitoring during the osseointegration process.

For many patients about to undergo this treatment, it is often recommended that a tape recording be made and photographs taken to be used as a basis for comparison in subsequent visits. It is by comparing these initial findings with those of the last few visits that a decision will be made to continue with speech therapy or discharge the patient.

Preventive Durapatite Ridge Augmentation for Esthetic Fixed Prosthodontics

Thomas J. Balshi, D.D.S., Fort Washington, Pa.

A variety of tooth replacement materials have been used in an effort to maintain the edentulous residual ridge for support of complete dentures. In addition, vital tooth root retention methods have been used to maintain the alveolar ridge. When treatment plans can be developed before extraction, a form of preventive ridge augmentation can be used to maintain the position of the gingival and mucosal tissues to be associated with the pontic area.

Diagnosis and Treatment Plan: An accurate clinical and radiographic evaluation is performed.

Laboratory Preparation: With the use of a diagnostic cast, the stone abutment teeth are prepared and the teeth to be removed are eliminated from the cast to a level 2 mm subgingivally. Socket preparation to a depth of 2 mm below the crest of the gingiva will permit the provisional restoration to later form a mechanical seal over the opening of the extraction site.

The fixed partial denture provisional restoration is first completed in wax and then invested and heat processed in acrylic resin.

Clinical Treatment: The abutment teeth are prepared before the removal of hopeless teeth to permit the prosthodontist to function in a bloodless field.

Every effort is made to remove the hopeless teeth intact without disturbing the surrounding supporting tissue.

To attain proper healing of the extraction opening and later permit appropriate oral hygiene, the oval surface of the pontic must be completely smooth and indentation free. All occlusal refinements and esthetic adjustments are made and the provisional restoration is completely polished and prepared for cementation.

Preventive Ridge Augmentation: Appropriate synthetic bone grafting materials such as Periograf (Cooke-Waite Laboratories, Inc., N.Y., N.Y.) in durapatite granule form (size 40 to 50 mesh) are moistened with a small amount of local anesthetic. A sterile amalgam carrier is loaded with the synthetic bone augmentation material and placed in the thoroughly cleansed socket. Excess hemorrhaging is carefully sponged from the extraction site opening. Surgical suction

should be avoided at this time so that the superficial durapatite crystals are not lost.

The extraction site is filled with the durapatite crystals. The provisional restoration is tried in the mouth again to determine whether the socket has been overfilled, preventing the pontic and abutment teeth from completely seating. A 1 mm space should exist between the durapatite crystals and the residual ridge surface of the pontic. A gelatin or collagen material is used to cover the durapatite crystals before cementation. Cementation of the provisional restoration compresses the Gelfoam material and seals the extraction site opening.

Final Prosthesis Pontic Design:

The pontic design of the final restoration should mimic closely the form established by the provisional restoration and should contact the residual ridge completely. The form of the pontic's ridge-facing surface should be totally convex and is generally considered oval in form. The surface must be extremely smooth. The porcelain is polished and highly glazed and contacts the mucosal tissues in the extraction site depression. The most apical point of convexity should be in the labial quarter of the root face.

Radiographic Follow-up and Clinical Evaluation: Patients should be re-evaluated periodically. A 2½-year follow-up of nine patients showed no clinical or radiographic change in pontic-residual ridge relationship.

**Journal of Prosthetic Dentistry*, September, 1987, Vol. 58, No. 3.

Branemark's Prosthetic Gold Screws

Lars Jorneus

The basic components of the Branemark Method of Osseointegrated Implants are all based upon threaded screw technology. Screws have many advantages over other types of fasteners, but they do sometimes work themselves loose.

Why do abutment screws and gold screws sometimes work loose? How can this be prevented?

The gold screw previously used had a conical head which—due to research and development—changed to a flat head, having distinct mechanical advantages over the conical design.

Tightening screws

The twisting force applied to the screw during tightening is torque and measured in Newtonmeters (Nm). With the small screws used in the Branemark System, it is more convenient to use Newtoncentimeters (Ncm) to specify tightening torques. 1 Nm = 100 Ncm.



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The recommended torque can be approached by keeping in mind that 20 Ncm is almost the maximum torque which can be applied by hand with a standard screwdriver.

Screws working loose

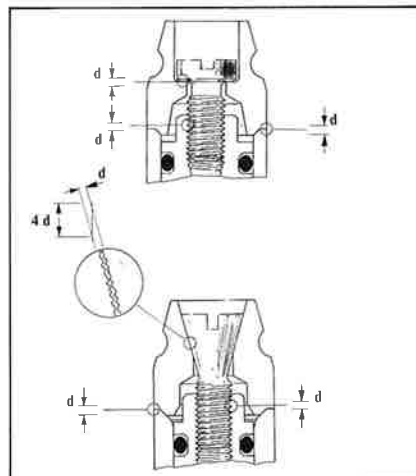
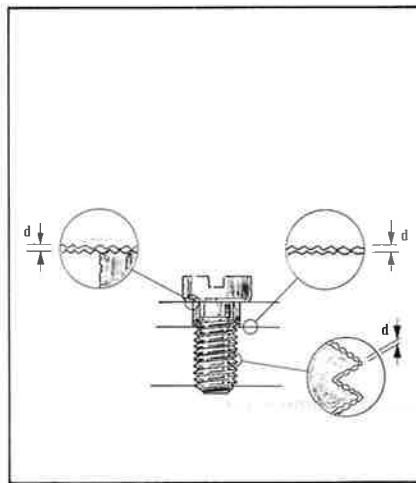
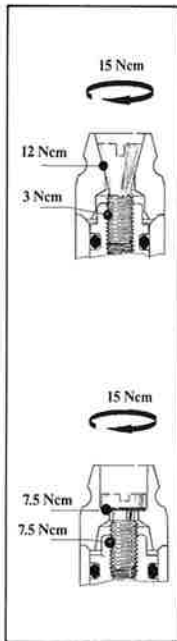
There are three important factors which affect screw loosening: *pre-load, screw elasticity and settling.*

Pre-load

In screw tightening, a constant tensile force is built up. This "pre-load" should be as high as possible.

A torque of 15 Ncm is applied to both the screws. In the conical screw, 12 Ncm is lost in the conical part and only 3 Ncm is transferred to the threads. This gives a tensile force of 120 N. However, the screw with the flat head loses only 7.5 Ncm and 7.5 Ncm is transferred to the threads, giving a tensile force of 300 N.

When tightened with 15 Ncm, there is a screw elongation of 12 μ m in the flat-headed screw and 1.6 μ m in the conical.



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The Tissue Integrated Prosthesis—An Evaluation of Impression Techniques

Dr. Mark R. Spector

The research presented was based on the Branemark Implant system, but the basic principles being studied may be applicable to any of the implants which achieve and maintain a state of osseointegration.

A primary requirement of the superstructure prosthesis is to fit the supporting implants in a passive manner. This is evaluated clinically through visual observation and patient response to the prosthesis being tightened into place. Prolonged tension on the implant fixtures can result in ischemia, bone microfractures and a loss of integration around the implant fixtures.

In this study, three different impression techniques were evaluated for their ability to accurately reproduce the implant fixture location on a working cast. Distortions in this initial transfer translate into an ill fitting superstructure which fails to fit in a "passive" manner.

Three techniques were used. *First*, a Duralay resin-dental floss matrix around transfer copings with a polysulfide rubber base pick-up impression. *Second*, a polyvinyl siloxane impression made over the hydrocolloid impression copings and *third*, a condensation reaction silicon impression made over the hydrocolloid impression copings. Five impressions were made with each technique. Casts were made and serial measurements were recorded of each abutment under a microscope with a micrometer controlled measuring platform. On a separate abutment replica mounted in a resin block, recordings were made to determine the error produced by placing and removing the transfer copings repeatedly. This resulted in a minor source of error which compounds itself each time the prosthetic elements are transferred.

The results of the study indicated that measurable distortions resulted from three techniques tested. The error ranged from 0.02 mm to 0.18 mm in the horizontal plane and 0.085 mm in the vertical axis. Statistically, it was not possible to demonstrate a difference between these techniques.

In a second study, a photoelastic evaluation was made to determine the magnitude of stress, if any, which is produced in a model simulating a clinical situation by fabricating a superstructure using different impression techniques.

Stress patterns were detected when the frame was made using the Duralay and dental floss matrix. Sectioning and soldering the frame resulted in greater stress patterns than the parent frame. An alternative impression technique eliminating the transfer copings and picking up the gold cylinders directly off the master cast with the impression plaster yielded a superstructure that was essentially stress free. Intentional distortion of the superstructure up to approximately one millimeter resulted in a frame which fit visually, but resulted in a highly stressed photoelastic model.

In conclusion, this study demonstrates the need for a highly accurate and predictable impression procedure in recording the position of the implant fixture intraorally, as well as the apparent difficulty in objectively evaluating the fit of the superstructure intraorally.

*Pacific Coast Society of Prosthodontists Newsletter, October, 1987.

Provisional Fixed Restorations For Partially Edentulous Patients With Osseointegrated Implants

Dr. Paul Binon

The advent of the Branemark (Nobelpharma) Implant, and its body of basic and clinical research, has challenged our perception of the endosseous implant. The creation of a viable bone implant interface now offers previously undreamed of reconstructive solutions.

A new technique for provisionalizing partially edentulous patients being restored with Branemark osseointegrated implants has been developed. Following surgical placement and the prescribed time interval necessary for osseointegration, a second surgical procedure for the exposure of the fixtures and placement of the abutment cylinders is scheduled. *Balshi described a technique in which a conversion prosthesis is used following fixture exposure.*

A transitional denture that was previously constructed and worn, is modified to receive gold cylinders. After considerable modification, the transitional denture is converted into a provisional fixed restoration that approximates the definitive restoration. This conversion prosthesis effectively eliminates the use of healing caps, and permits the immediate utilization of the osseointegrated fixtures.

A similar rationale can be applied to the partially edentulous patient. Mounted diagnostic casts are waxed and duplicated in stone. A thermal plastic form is made and trimmed to encompass the area to be restored. After the abutment is seen by the prosthodontist, and the matrix is tested in the mouth, the surface over each abutment is scored, and the impression coping is attached to the abutment with a guide pin screw. If the impression coping interferes with passive eating of the matrix, it is shortened with a separating disc. The coping is modified until complete clearance exists. Grooves and other irregularities should be added to the cylinder to ensure retention in the resin of the fixed partial denture.

A small piece of rubber dam is placed over the abutment to cover the area of the incision. Natural abutments are lubricated with vaseline. A cold cure resin is mixed and poured into the matrix, the matrix is seated and screwed into place. Once the initial set begins, the screws and matrix are quickly removed, and allowed to reach a final set. The provisional fixed partial denture is trimmed and finished to ideal tissue clearance contour with optimal embrasure and contact form. A gold screw is used to

continued on page 6

attach the fixed partial denture to the abutments.

This technique effectively eliminates the use of healing caps, and gives the patient immediate function after abutment exposure. It permits the patient to preview the benefits of the final restoration and gives the clinician the opportunity to evaluate the proposed design and contour of the definitive restoration. The technique also increases patient comfort, function and esthetics.

*Pacific Coast Society of Prosthodontists Newsletter, October, 1987.

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Screws continued from page 5

Settling

No surface is completely even. Because of this roughness, any two surfaces are in contact with one another only when the high points on one surface meet the high points of the other surface.

When the screw interface is subjected to external loads, micro-motion will occur between the surfaces. As a result of this motion, the tops will wear. The magnitude of the settling is dependent on the initial surface roughness and on the loading force.

Settling occurs in three places: under the head, at the area of contact between the gold cylinder and the abutment and on the threads. The total settling for the flat screw can be stated as $d + d + d = 3d$. For the conical screw, we have an equivalent settling of $4d$ under the head, due to the conical angle, and a total settling of $4d + d + d = 6d$.

Design sensitivity

When the total settling effect is greater than the elastic elongation force of the screw, it works loose. This happens because when the elastic elongation ceases there is no longer any tensile force in the stem.

In the case of the flat screw there is a total settling of $3d$ and an elastic elongation of 4 um . The maximum allowable settling is: $d = 4/3 = 1.3 \text{ um}$ for each pair of surfaces.

With the conical-headed screw there is a total settling of $6d$ and an elastic elongation of 1.6 um . The maximum allowable settling is: $d = 1.6/6 = 0.26 \text{ um}$ for each pair of surfaces.

Consequently, the design with the flat head is much less sensitive to settling and screw loosening.

(Editor's note: Recommended torques are best achieved using a calibrated torque wrench or similar device. The editor has used a modified contra angle with flattened drive shaft. Six inch straight hemostats completely tightened on the shaft break loose at approximately the same torque applied by hand. Nobelpharma has refined this idea and has recently made available a "torque driver" instrument.)

*Nobelpharma News, 1987, Vol. 1, No. 1.

excellent magnetic characteristics. The side wall of the inner cap, made from non-magnetic stainless steel, is soldered to the endoplate which is made of magnetic stainless steel. There should be a space between the yoke and the endoplate to avoid the jumping of magnetic flux. This space is filled with a synthetic resin adhesive. The double cap works for anticorrosion of the magnet and also for guiding the magnetic flux from another pole to the object, creating a stronger attractive force.

Another attachment called the "molar type" is used for posterior teeth. This larger magnet is 4 mm in diameter. The outside diameter is 6 mm and the height is the same as the regular type at 2.7 mm.

The average strength was comparable to those of conventional mechanical attachments.

Leakage of Magnetism

There is some anxiety about the effect of magnetism on the surrounding tissues in the oral cavity. To investigate the real conditions, the actual amounts of magnetic field strength around the magnet and magnetic attachment were measured with a gauss meter. On the surface of the 3 mm magnet it exceeded 3,000 gauss, but around the closed-field magnetic attachment, it was recorded at less than 40 gauss.

Magnet Plaque

Rather specific plaque has been found around the magnets. It accumulates in a relatively short time and is hard to remove. It was hypothesized that components such as iron in the food debris would be collected unexpectedly by the magnetic field in very small amounts. Instead, qualitative analysis showed that calcium and phosphorus were the major components.

The magnet plaque contains inorganic components like dental calculus although their clinical appearance is similar to plaque.

*Presented at ICP Meeting, Interlaken.

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Crown Systems continued from page 1

Advantages and Disadvantages

CERESTORE crowns were considered as quite esthetic until the manufacturer changed the shades of the CERESTORE porcelains. A core visible at the margins, as well as a 10% fracture rate after two years were the most important disadvantages of this system which has recently been withdrawn from the market.

DICOR crowns provide a good marginal fit. The major inconvenience is a too great translucency of the entire crown, that requires time consuming attempts to mask underlying post and cores.

VITA H-C crowns can be considered as the most esthetic all-porcelain crown, requiring minimum specific equipment. Due to contraction of the alumina core following each firing cycle, considerable readjustments of the inner surface of the core became necessary.

*Presented at ICP Meeting, Interlaken.

Caution continued from page 1

Complications have arisen, however, for patients who have had osseointegration treatment in the area where durapatite or hydroxyapatite was previously used. In these areas, a higher percentage of the implants have failed to osseointegrate than normally expected; they will not function as supporting abutments for fixed bridge-work. Biologically, it may be possible that the living tissue surrounding the hydroxyapatite crystals is inappropriate as an osseointegration bed. There may be a lack of osteoblastic activity, preventing appropriate bone remodeling around the implant.

Additional recent experience with complete denture patients who five or more years ago had undergone HA ridge augmentations now present with decreased mucosal tolerance in the denture bearing areas.

These ridges have appeared clinically inflamed and more sensitive to irritation than even severely atrophic ridges with inherent poor denture stability.

Considering the surgical trauma of the HA augmentation technique, especially if followed by a skin graft vestibuloplasty, in light of the final prosthetic result—a removable and sometimes highly movable denture—serious consideration must be given to the prescription of osseointegration. Branemark's research and over 20 years of excellent clinical results have proven this method to have an outstanding and highly predictable long term favorable prognosis.

The relationship of HA and similar substances require additional research, especially in areas where the potential for future osseointegration may exist.

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be cantilevered porcelain-fused to metal bridgework only removable by the prosthodontist.

To avoid extremely long teeth or the presence of long metallic looking posts one can imitate the gingival part of the superstructure with pink-colored porcelain or a gingival epithesis made out of silicone.

With implant retained overdentures one can offer the patient a really simple solution.

Together with Metaux Precieux, Neuchatel, Switzerland, the authors designed a new retention knob and housing system. The knob can be screwed on the IMZ or Branemark (Nobelpharma) Implant. It is made out of titanium and the housing out of a water resistant acrylic material reinforced by a titanium ring.

Immediately after the abutment connection, one can screw the retention knobs on the above mentioned implants and polymerise the housings into the temporary over-dentures.

*Presented at ICP Meeting, Interlaken.