RAPID-FIRE PRESENTATIONS:

WEDNESDAY, JULY 30, 2014

4:00 – 5:30 p.m. **Room: Emerson Burkhart A&B**

POSTER SESSION

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5:30 – 7:00 p.m.

(BIO-RF-P001-2014) Brazing Characteristics of ZrO_2 and Ti-6Al-4V Active Metal for Dental Implants

Seho Kee, University of Seoul, Korea; Flora Jung, University of Western Ontario, Canada; Youngku Heo, Neobiotech, Korea; Jong-Min Lee, Micro NX, Korea; Wonjoong Kim, Jaepil Jung, University of Seoul, Korea

Active metal brazing is a convenient method of creating a joint of high quality. However, in ceramic/metal joining, the poor wettability of conventional filler metals on ceramics is a critical problem of the brazing method. To improve wettability, active elements such as titanium, zirconium, or hafnium are added to conventional filler metals for the chemical affinity between the active elements and the oxygen in oxide ceramics or the carbon and nitrogen in carbide and nitride ceramics, respectively. ZrO2 and Ti-6Al-4V alloys are the most commonly used biomedical materials and are used especially for dental implants. ZrO2 has high hardness, good corrosion resistance and is biocompatible. Ti-6Al-4V alloy also shows good strength, corrosion resistance and biocompatibility. In this study, brazing characteristics of zirconia and titanium joints using an Ag-Cu-Sn-Ti filler metal was investigated. The brazing sample was heated in a vacuum furnace under 5 x 10-6 torr atmosphere, while the brazing temperature was altered from 700 to 800°C for 30 min. The ZrO2 and Ti-6Al-4V samples were brazed for dental applications using an Ag-Cu-Sn-Ti brazing alloy. The samples were brazed well in the range of 700 ~ 800°C. The microstructure of the brazed joint showed an Ag-rich matrix phase, Cu-rich island shape and two kinds of interfacial intermetallic layers consisting of Ti-Cu-Sn. The thickness of intermetallic layers increased with brazing temperature.

(BIO-RF-P002-2014) Monodisperse, submicron calcium phosphate sphere synthesis in SBF solution at 55°C

A. Cuneyt Tas, University of Illinois, USA

SBF (simulated/synthetic body fluid) solutions, which mimic the blood plasma electrolyte, are developed and historically used for the in vitro testing of synthetic biomaterials at the physiological temperature of 37°C. Calcium phosphate (CaP) forming in an SBF solution can have no cytotoxicity or no issue related to its biocompatibility, if the Tris or Hepes (50 mM), which are not present in human blood plasma, historically used in preparing SBF solutions are also eliminated during the SBF preparation. This study reports how to synthesize monodisperse carbonated CaP spheres (180 to 240 nm in diameter) only by heating a stirred (1000 rpm) SBF solution at 55°C for less than 20 min. Two different Tris- or Hepes-free SBF solutions (of pH 7.4) were developed and both were able to produce such monodisperse CaP spheres. The ion concentrations in such SBF solutions may be multiplied by a factor of 10 to readily increase the yield of CaP spheres. Samples were characterized by SEM, TEM, XRD, FTIR, ICP-AES and BET analyses. Such submicron and monodisperse CaP spheres are suitable for drug delivery, as well as orthopedic and dental applications.

(BIO-RFP-003-2014) Mechanical Analysis of Novel Injectable Cement for Minimally Invasive Treatment of Spinal Fractures

Brett Dickey, Daniel Boyd, Dalhousie University, Canada

An extensive body of literature is devoted to the research for alternatives to conventional injectable acrylic cements indicated for vertebroplasty (VP) and kyphoplasty (KP); procedures for the palliative treatment of vertebral compression fractures. Ideal alternatives are suggested to: i) be injectable for 5-10 min, ii) set within 15 minutes, and iii) exhibit > 30 MPa of compression strength1,2. Aluminum-free glass polyalkenoate cements (GPCs) possess many intrinsic qualities to make them attractive for VP/KP. However, until recently their quick setting nature (c. 2 min) has made them impractical for clinical use. Nascent literature shows the inclusion of germanium in zinc-silicate glasses as the key to improving the clinical utility of these materials3. These Ge based GPCs exhibited working times (a surrogate measure of injectability) up to 10 min, setting times of 15–36 min, matched with 1 day compression strengths of 36–41 MPa. However, the mechanical data of the Ge based GPCs is limited and initial trends indicate significant decreases to < 30MPa after 180 days, hindering the clinical potential of these materials due to impaired long term performance. The objectives of this study are: i) expand the mechanical characterization of the Ge based GPCs, ii) develop mathematical models using design of mixture software to relate the affects of glass composition to GPC mechanical properties, and iii) if these models can be used to mitigate the mechanical decline of maturing Ge based GPCs.

(BIO-RF-P004-2014) Bioactive Ti metal and its alloy with calcium titanate layer releases metal ions effective for bone growth and antibacterial

Seiji Yamaguchi, Shekhar Nath, Takashi Kizuki, Tomiharu Matsushita, Tadashi Kokubo, Chubu University, Japan

The present authors early showed that Ti metal and its alloy form an apatite layer on their surfaces in body environment and bonds to living bone, when they were subjected to NaOH, CaCl2, heat and water treatments to form Ca-deficient calcium titanate on their surfaces. In the present study, various kinds of ions such as Ag+ ion effective for antibacterial effect, and Mg2+, Sr2+, Li+ and Zn2+ ions effective for bone growth were incorporated into the Ca-enriched surface layer. The treated Ti metals released Ag+, Mg2+, Sr2+ and Zn2+ ions slowly up to 7 days in phosphate

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buffered saline, whereas it released Li+ ions rapidly within 3 h due to the formation of soluble $LiTi_2O_4$ and $Li_2Ti_2O_4$. When the treated metals were soaked in a simulated body fluid with ion concentrations nearly equal to those of human blood plasma, all of them formed apatite fully on their surfaces within 3 days. These novel bioactive Ti metal and its alloys could be useful for various types of dental and orthopedic implants.

(BIO-RF-P005-2014) Tetragonal zirconia stabilization in ZPTA ceramic for arthroplasty

Alessandro Alan Porporati, Meinhard Kuntz, Robert Streicher, CeramTec GmbH, Germany

Ceramics are excellently suited for applications in arthroplasty, mainly total hip, knee and shoulder replacement. As the most prominent representative of this demanding type of material, BIOLOX®delta is widely used and very successful in the market for more than 10 years. The ability of zirconia phase transformation ($t\text{-}ZrO_2 \rightarrow m\text{-}ZrO_2$) in zirconia-platelet toughened alumina (ZPTA) ceramics is an indispensable prerequisite for their excellent mechanical properties. The degree of stabilization of the zirconia tetragonal phase at body temperature is essential for the desired toughening mechanism. Y_2O_3 is the most widely used $t\text{-}ZrO_2$ chemical stabilizer; also microstructure and grain size contribute to $t\text{-}ZrO_2$ phase stabilization. Stabilization must be achieved such that no material degradation will occur in body environment, i.e. in aqueous liquid (synovia), which is known to potentially trigger phase transformation at the surface of ceramic components. In this study, it is shown how phase stabilization in BIOLOX®delta as a reference material is excellently balanced by means of optimal mechanical performance and environmental stability.

(BIO-RF-P006-2014) Oxide Nano-textured Surfaces Grown from Titanium Alloys for Enhanced Cell Adhesion and Growth

Derek Miller, Sheikh Akbar, The Ohio State University, USA

Recent work has shown that nano-textured surfaces can enhance adhesion and proliferation of bone cells, chondrocytes and bone-derived stem cells to the surfaces of various titanium alloys commonly used as bone and dental implants. The polished titanium alloy surfaces are oxidized in a controlled manner to grow a ceramic layer of oxide nanowires and other nanostructures which provide a better 3D environment on which cells can more readily attach themselves. Electron microscope images have shown a strong interaction of both kinds of cells and the nano-textured surfaces, latching onto and infiltrating into the structures as well as growing in a more three-dimensional manner than the control cells grown on the polished alloy. Enhanced cell proliferation has been shown in human osteosarcoma (HOS) and chondrocyte joint cells grown on the oxide nanowire surfaces. The method of growth is very inexpensive and highly scalable. The method has also proven successful on titanium alloy films sputtered onto ceramic substrates. Ongoing work is also applying these growth methods to new titanium alloys being developed for biomedical implant applications at Ohio State University.

(BIO-RF-P007-2014) The use of ceramic-to-metal seal technology in implantable devices

Emma Gill, Morgan Advanced Materials, USA; John Antalek, Chris Vaillancourt, Stephen Gilbert, Morgan Advanced Ceramics, USA

Implantable electronic biomedical devices are used clinically to diagnose and treat an increasing number of medical conditions ranging from life threatening heart complaints to profound deafness and obesity. The devices employ hermetic packages that often incorporate electrical feedthroughs made with ceramic-to-metal bonding technologies which are described herein. The feedthrough component allows electrical signals to be transferred into and out of the device. Both hermeticity and biocompatibility of such implantable feedthroughs are important, as both moisture and positive mobile ion contamination from the saline environment of the human body can lead to compromised performance or catastrophic failure. As such, all the materials chosen for the feedthrough must be biocompatible, non-porous and not susceptible to degradation but, in addition, the individual materials are chosen to perform specific functions. The feedthroughs discussed consist of platinum conductors, alumina ceramic insulators and a titanium flange to attach the feedthrough to the rest of the device. Typically there are one or more alumina ceramic components that insulate the Pt conductors from one another and from the Ti flange. These can be in the form of 95%+ polycrystalline Al_2O_3 ceramics or single crystal synthetic sapphires. Morgan Advanced Materials has two technologies for manufacturing implantable feedthroughs. The brazing technology utilizes a thin film metallization applied to the ceramic to allow gold braze to wet and bond to the ceramic component. Morgan has also developed an innovative high density feedthrough (HDF) technology where the Pt conductors are bonded directly to the alumina. The term "high density" denotes the high concentration of conductive pathways in a given area compared to what is possible with traditional feedthrough technologies. The fabrication process utilizes multilayer high temperature co-fired ceramic technology in conjunction with platinum leads. Before co-firing, green alumina substrates are interleaved with linear, parallel Pt trace arrays. During sintering the shrinkage experienced by the ceramic, along with a reaction between alumina and Pt, create a hermetic bond between the two components. The implementation of such an HDF technology allows for significant package miniaturization, allowing greater flexibility in surgical placement as well as less invasive procedures for implantable electronic biomedical devices. HDFs fabricated using this process with 100 conductors and lead-to-lead spacings as low as 400 microns have been helium leak tested repeatedly and found to exceed industry-accepted standards with helium leak rates in the range of 10^{-11} mbar-l/s.

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(BIO-RF-P008-2014) Longitudinal Evaluation of Bioactive Strip Implanted into the Distal Condyle of New Zealand White Rabbits

Zehra Tosun, NovaBone, USA

Twenty-four (24) NZW rabbits randomly assigned to three (3) study groups (8 per group) underwent bilateral surgery to create a critical sized defect in the distal femoral condyle. The animal's left leg received the Test and the contralateral side (the animal's right leg) received the Control Device. Histopathologic and histomorphometry evaluation found both materials to be substantially equivalent in the ability to induce new bone formation in and around the defect. Defects implanted with the test article showed a statistically significant increase in new or native bone in and around the defects at Day 83 compared to those treated with the control device and the mean measured percent of native or new bone in defects was significantly greater at Day 83 compared to Day 22. Residual implant material in the defect decreased significantly over time for both devices and by the final necropsy interval the amount of residual implant material was comparable between defects treated with either of the two devices. Mechanical compression testing indicated that both materials were substantially equivalent 3 weeks following surgical implantation. At 6 and 12 weeks, maximum load, stiffness, maximum compressive stress, and elastic modulus values for specimens treated with the Bioactive Strip Test Device were significantly higher than for those treated with the predicate Control Device. Mechanical compression testing indicated that both materials were substantially equivalent 3 weeks following surgical implantation. At 6 and 12 weeks, maximum load, stiffness, maximum compressive stress, and elastic modulus values for specimens treated with the Bioactive Strip Test Device were significantly higher than for those treated with the predicate Control Device.

The in vivo performance of the BIOACTIVE Strip 510(k) subject device is substantially equivalent to that of the predicate NovaBone Porous device (K090731/K060432) as demonstrated by implantation in a rabbit model.

(BIO-RF-P009-2014) Cytotoxicity Testing of Aluminum Magnesium Boride Powders for Medical Implant Applications

Matthew Little, South Dakota School of Mines & Technology, USA; Peter Hong, New Tech Ceramics, Inc., USA; Grant Crawford, South Dakota School of Mines & Technology, USA

Wear failures remain a common failure mode of load bearing implants with articulating surfaces. The novel ultra-hard ceramic AlMgB14, also known as BAM, offers a new perspective for reducing wear of load bearing surfaces. BAM is extremely lightweight, is the third hardest material on earth, and has a very low coefficient of friction. We report on the relationship between BAM processing/composition and in vitro cytocompatibilty behavior. Three BAM powders of varying composition and processing (i.e. AlMgB14, AlMgB14 + TiB2, and AlMgB14 + TiB2 densified powder) were first characterized using standard materials characterization methods and subsequently subjected to in vitro cytocompatibility testing in the presence of bone cells (mouse pre-osteoblasts). In addition, solid BAM samples (i.e. AlMgB14 and AlMgB14 + TiB2) were subjected to direct contact in vitro cytocompatibility testing. The results of this study show that BAM is indeed a promising material for biomedical application, especially applications requiring excellent wear resistance.

(BIO-RF-P010-2014) Nanodiamond for Sensing Applications

Nirmal Govindaraju, Jonathan Gonzales, Marshall Harrup, Raj Singh, Oklahoma State University, USA

Diamond is a chemically inert material with high thermal conductivity, Young's modulus, and dielectric breakdown strength which can be functionalized for selective attachment of molecules to its surface. Nanodiamond pillars (NDPs) by virtue of their structure can function as "cantilevers" with distinct resonant frequencies and are well-suited for biological and chemical sensor applications. The resonant properties of NDPs have an intimate relationship with the synthesis conditions and microstructure. Therefore, it is important to delineate the differences in microstructure evolution and phase purity for NDP structures fabricated under different diamond synthesis conditions. This presentation explores two approaches for NDP fabrication – "top-down" and "bottom-up". The "top-down" approach utilizes selective etching by inductively coupled plasma to realize patterned diamond structures on Si substrates. The "bottom-up" approach relies on selected area deposition of diamond on Si to achieve the same result. Three different gas phase chemistries, 99% H2: % 1 CH4, 60%Ar: 39% H2: % 1 CH4, and 85%Ar: 14% H2: % 1 CH4, spanning the microscrystalline and nanocrystalline regime will be used for fabrication. Scanning electron microscopy and Raman spectroscopy results will be shown in order to compare and contrast the microstructure and phase purity of the fabricated structures. These results will lay the foundation for the development diamond-based sensor technology for biological and chemical substance detection applications.

(BIO-RF-P011-2014) Biomimetic Bone Prepared via a Polymer-Induced Liquid-Precursor (PILP) Mineralization Process

Douglas Rodriguez, Laurie Gower, University of Florida, USA

Bone is a hierarchical organic-inorganic composite, which at the nanostructural level consists of an assembly of collagen fibrils that are embedded with uniaxially-aligned nanocrystals of hydroxyapatite. Our in vitro studies have shown that bone's nanostructure can be reproduced using a polymer-induced liquid-precursor (PILP) mineralization process, where the polymeric additive consists of acidic polypeptides (e.g. polyaspartic acidic) or proteins (e.g. osteopontin) that mimic the action of non-collagenous proteins found in bone. The high charge density of the polyanionic additive sequesters ions such that liquid-liquid phase separation occurs, forming nanodroplets of a hydrated amorphous mineral precursor that can infiltrate into the interstices of collagen fibrils, leading to an interpenetrating organic-inorganic composite that emulates bone's nanostructure. Through optimization of reaction parameters, compositions matching bone (60-70 wt% mineral) have been achieved in a variety of collagen scaffolds, including both reconstituted type-I collagen and biogenic (bone, dentin, tendon) matrices. We believe that by mimicking the hierarchical structure of bone from the nano- to micro-structural level, it will be possible to match the mechanical properties of bone. Therefore, our current studies are directed at assembling parallel-fibered collagen which can be mineralized in the form of laminated composites, mimicking the lamellar microstructure of bone. With respect to bioactivity, we have found that cell signaling mechanisms provided by the osteopontin additive may provide a means for modulating osteoclast activity, thus providing a means for tailoring the resorption rate of these bone-like composites. The long-range goal of these studies is to prepare bioresorbable load-bearing bone substitutes that can be remodeled through the natural bone remodeling unit (BRU). As opposed to the common approach of using biodegradable implants, which require careful matching of the degradation rate to bone ingrowth, are goal is to modulate the synchronized activity of the multicellular BRU, which would then enable load-bearing capacity to be maintained throughout the remodeling of the implant, as occurs during natural bone remodeling.

(BIO-RF-P012-2014) Fabrication of dipyridamole loaded core-shell polycarbonate urethane nanofibers membranes by coaxial electrospinning for antiplatelet application

Yuansen Qin, The First Affiliated Hospital of Sun Yet-sen University, China; Yong Zhao, Beihang University, China; Zuojun Hu, The First Affiliated Hospital of Sun Yet-sen University, China

Introduction: The patency of synthesis small diameter vascular graft is still far from satisfaction due to acute thrombosis and intimal hyperplasia. To improve hemocompatibility, antiplatelet drug dipyridamole (DIP) was encapsulated in polycarbonate urethane (PCU) core-shell nanofibers mats by coaxial electrospinning.

Methods: PCU solution and DIP/ polycaprolactone compound solution served as sheath and core fluid respectively for coaxial electrospinning process. Three groups of nanofibers with different core fluid flow rate were prepared. Surface morphology and internal structure were characterized by scanning electron microscope (SEM) and transmission electron microscope (TEM), respectively. Physical state and distribution of DIP in nanofibers were detected by differential scanning calorimeter (DSC) and X-Ray diffraction (XRD). Drug release profiles and platelet adhesion test were tested in vitro.

Results: Coaxial electrospinning process was conducted smoothly and continuously under selected conditions. SEM and TEM photographs showed that linear fibers without beads was fabricated and clear core-shell structure was generated. The diameter of nanofibers and core structure increased with the flow rate of internal solution. DSC and XRD revealed that the whole system formed solid dispersion and DIP was dispersed in polymer matrix in an amorphous state. In vitro drug release test presented that the profile had two phases consist of Initial burst release (16.1±1.1%, 53.6±2.6% and 76.4±3.9%, $p<0.05$) and sustained release govern by the first Fick's law and the diffusion mechanism. A more flat curve occurred when the diameter of PCU sheath increased since PCU sheath worked as a barrier restricted DIP release from core drug reservoir. Platelet adhesion text in vitro demonstrated that DIP maintained its antiplatelet effect after coaxial electrospinning process and could present distinguished antiplatelet activity (401±107, 11842±1299 and 26552±3642/ mm2, $p<0.05$) on the 30th day.

Conclusion: DIP loaded core-shell nanofibers mats with good hemocompatibility was fabricated conveniently by coaxial electrospinning, which has great potential in the field of tissue engineering vascular graft.

(BIO-RF-P013-2014) The Potential of Nanostructural Ca-Aluminate based Bioceramics within Odontology

Leif Hermansson, Applied Research Sweden AB, Sweden; Emil Abrahamsson, Doxa Dental Inc., USA

The presentation deals with the chemically bonded Ca-aluminate based bioceramics (CA) and their potential within odontology. Nanostructures including nanocrystals and nanoporosity are easily formed in the CA-system due to a low solubility product of the phases formed. The CA materials were synthesized by Doxa AB. Added phases were glasses or ZrO_2 depending on the intended applications. For early hardening a glass ionomer can be used. The nanostructures have been studied using HRTEM in combination with focused ion beam microscopy (FIB) for site-specific accuracy preparation (Ref. 1). Mechanically related properties (flexural strength, compressive strength, fracture toughness and Young´s modulus) and biologically related properties (biocompatibility, bioactivity, tissue integration and antibacterial properties) were evaluated using ISO Standards. The nanostructures contribute to high mechanical strength, and complete sealing of contact zones to surrounding materials. Practically related properties deal with 1) Nanostructural integration with reduced risk of secondary caries and restoration failure, 2) Dimensional stability (no shrinkage) and reduced post-operative sensitivity, 3) Environmental friendliness, 4) Moisture tolerance, and 5) Excellent retention towards different types of tissues and biomaterials. The CA-based bioceramics are close in chemistry to apatite, and the thermal and electrical properties are close to those of hard tissue. Refs. 2-3. Several dental products have been identified based on material data, pre-clinical and pilot studies, and on-going clinical studies; Dental cements, endodontic sealer, bases, restoratives, stabilising materials related to peri-implantitis, and pastes for augmentation, and as coating materials.

Supported by Doxa AB, Sweden.

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(BIO-RF-P014-2014) Nanomaterials for Biomedical Applications

Cheol Woon (CW) Kim, MO-SCI Corporation, USA

Porous-wall hollow glass microspheres (PWHGMs) are a novel form of glass material consisting of a 10 to 100 μm diameter hollow central cavity surrounded by a 1 μm thick silica shell. A network of nanometer-scale channels (10 to 300 nm diameter) completely penetrates the shell. Morphology and potential biomedical applications will be discussed. Surface-enhanced Raman scattering (SERS) active particles can be produced from a sol-gel process. They are silica-encapsulated gold nanoparticles attached with Raman-active optical reporter molecules and can be used for rapid diagnosis of diseases. The features of these SERS particles will be discussed.

(BIO-RF-P015-2014) Cell behavior on etched, crystal-containing poly(propylene fumarate) scaffolds for bone tissue engineering

Ruchi Mishra, Rachel Fishbein, Tyler J. Bishop, Ryan S. Sefcik, Briana A. Swan, The Ohio State University, USA; Martha O. Wang, John P. Fisher, University of Maryland, USA; David Dean, The Ohio State University, USA

Light-based 3D printed poly(propylene fumarate) (PPF) scaffolds for bone regeneration have smooth, somewhat hydrophobic surfaces. Previous studies have shown an osteogenic effect from incorporating hydroxyapatite (HA) and beta-tricalcium phosphate (β-TCP) crystals. We added 100 nm, 1 μm, 10 μm or 100 μm size β-TCP and HA crystals to PPF scaffolds. We analyzed canine mesenchymal stem cell spreading via scanning electron microscopy at 4 hours and attachment via MTT assay at 48 hours. We observed a parabolic pattern for cell spreading with values increasing from 12.8 ± 3.7 μm and 11.1 ± 1.6 μm in the β-TCP and HA 100 nm groups, respectively, to 13.4 ± 6.1 μm and 24.1 ± 4.7 μm at 10 μm, and declined in both 100 μm crystal groups. Cell attachment showed a serially decreasing trend from 100 nm to 100 μm groups. The values for 100 nm HA and β-TCP were 0.16 ± 0.03 absorbance units (AU) and 0.14 ± 0.02 AU, respectively, while, the 100 μm values were 0.09 ± 0.02 AU and 0.08 ± 0.00 AU. We conclude: 1) cell spreading presented a parabolic pattern, peaking at the middle crystal sizes (1 and 10 μm), 2) cell attachment showed a serial downward trend.

(BIO-RF-P016-2014) Ion substituted nano CaP bone replacements with extended antibacterial activity

K. Madhumathi, T S Sampath Kumar, Rubaiya Y, Mukesh Doble, Indian Institute of Technology, India

Biomaterials with sustained antibacterial activity are highly beneficial when used as bone substitutes in bone and dental infections. Antibiotic loaded calcium phosphate nanoparticles such as hydroxyapatite (HA) and calcium deficient HA (CDHA) are efficient antibacterial bone fillers. Ions like zinc (Zn), strontium (Sr) and silver (Ag) have well known antibacterial activity. Substitution of such ions into HA/CDHA crystal structure endows them with inherent antibacterial potential independent of antibiotic drugs. Thus, the antibacterial activity of these nanoparticles extends long after the antibiotics are released. In our study, doxycycline was used as model drug to study the effect of ion substitutions in CDHAs on loading and release kinetics. An initial burst release followed by controlled release was observed from ion substituted CDHA which was established by an increase in antibacterial activity compared to pure CDHA. Our studies indicate that drug releasing ion substituted CDHAs can provide long-term protection against hard tissue infections.

(BIO-RF-P017-2014) Treatment of Connective Tissue Wounds with Bioactive Borate Glass Fibers

Steven Jung, Mo-Sci Corporation, USA

Bioactive borate glasses with angiogenic and healing properties were fabricated into nanofibers that mimic the microstructure of a fibrin clot for healing wounds. Several examples including traumatic acute wounds and also chronic non-healing wounds are shown before and during treatment in both humans and animals as examples of the fibers versatility. While wound closure in most examples is dramatic, the reduction in treatment time associated with these wounds is also significant. The wounds treated to date have been diverse, and include the lower leg, bottom of foot (front pad), the heel of the foot, the neck, the lower back, the upper chest (breast), and upper thigh in human patients. In the veterinary space, the fiber has been used to treat gunshot wounds, severe lacerations, jaw bone augmentation after tooth extractions, and damaged shells of sea turtles. The regenerated tissues typically have minimal scarring and the original defect area is difficult to detect visually once treatment is complete. The composition of the glass along with the fibrous microstructure of the pad mimic the initial stage of wound healing (formation of a fibrin clot) and stimulate the growth of new blood vessels to the area treated. The introduction of this fibrous microstructure appears to transform chronic wounds to acute wounds while soluble ions released from the glass aid in the healing process.

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(BIO-P018-2014) Influence of surfaces treatments, cements and aging on bond strength of Y-TZP ceramic

Lais Regiane Silva Concilio, University of Taubaté, Brazil; Marcelo Massaroni Peçanha, University Federal of Espirito Santo, Brazil; Cristiane Aparecida De Assis Claro, Ana Christina Claro Neves, University of Taubaté, Brazil

Objectives: Evaluate the influence of different surface treatments and aging on the bond strength of a phosphate (P) and self-adhesive (SA) resin cement using a yttria-stabilized zirconia (Y-TZP) ceramic material (Lava, 3M ESPE). Methods: One hundred Y-TZP blocks were divided in five groups according to surface treatments: 1-control (no treatment); 2-airborne-particle abrasion with 50-µm Al2O3; 3- tribochemical silica coating; 4-MDP primer and 5- tribochemical silica coating+MDP primer. Each group was divided into two subgroups (n=50), according to the luting agent: SA (RelyX U200, 3M ESPE) and P (Panavia F 2.0, Kuraray). The cements were manipulated according to manufacturer recommendations, placed into plastic tubes on the surface of the Y-TZP ceramic blocks and photoactivated. Half of samples (n=25) were submitted to the aging process (thermal cycling–3.000 times). The bond strength test was conducted and data were statistically analyzed using ANOVA and t Student's tests (p<0.05). Results: Before aging for P cement the silica coating (3) and silica coating+primer (5) presented the highest bond strength values (30.52MPa and 29.15MPa); For SA cement, the values did not showed significant differences; comparing the luting agents, there was no statistical difference between them, except in the control group where SA presented a higher value (26.05MPa) when compared to P (20.02MPa). After aging, all bond strength values decreased; P cement the silica coating (3) and silica coating+primer (5) showed highest values (16.36MPa and 15.73MPa); SA cement, there was no statistical difference between the groups except in the control group, which showed the worst result (9.78MPa); luting agent influenced significantly the bond strength values, being that SA cement showed higher values for all surface treatment when compared to the P cement. Conclusions: Aging decreased all bond strenght values for the two luting agents (P and SA); Silica coating provided better results and was considered an essential surface treatment for Y-TZP ceramic, when using P cement; for the SA cement, the surface treatment increased its complexity and may not be necessary because it had little influence on the bond strenght.

(BIO-P019-2014) The fabrication of new zirconia-based dental implants and the evaluation of their osseointegration using a mini-pig

Sheng-Yang Lee, Taipei Medical University, Taiwan; Jen-Chang Yang, Taipei Medical University, Taiwan; Sea-Fue Wang, Chung Kuang Yang, National Taipei University of Technology, Taiwan;

Zirconia implants with modified surface-treated and non-treated were used and compared to implants made of commercially titanium with surface-treated. Experimentally, zirconia implants were introduced into the maxilla and mandible of 10 mini-pigs. These ten mini-pigs were divided into 2 groups for sacrifice after implantation, for 8 weeks and 16 weeks. The implants could be analyzed to following. They are resonant frequency (RF) testing for implant stability, bone to implant volume (BIV%) analysis using Micro-Computed Tomography (Micro-CT). After that the samples were sectioned and analyzed bone to implant contacts (BIC) by scanning electron microscopy (SEM) and Masson Goldner's stain were used to evaluate osseointegration.

At the resonant frequency stability analysis, in the 8 weeks group, majorly showed that upper Zr surface-treated group were better. 16-week group is no statistically significant difference; while the detection time point, the upper Zr surface-treated and Zr surface-untreated which at the 16 weeks were better than 8 weeks group. BIV showed that, in maxilla, 8 weeks and 16 weeks showed Zr surface-treated better than Zr surface-untreated, in mandible, titanium SLA group were better than Zr surface-untreated. BIC either 8 weeks, 16 weeks, SEM or Masson Goldner, are displayed in the maxilla, Zr surface-treated and titanium SLA were no statistically significant difference, and Zr surface-treated were better than Zr surface-untreated. Also, we observed that tissue sections in Masson Goldner staining, more sponge bone and the non-calcified bone were red color in 8 weeks group; also can be observed at week 16 the green mature bone calcification noted, and Zr surface-treated group can find more lamellar bone.

The results demonstrated that zirconia implants with modified surfaces result in a well osseointegration that is comparable with that of titanium implants. Simultaneously, the results from our study suggest that zirconia implants with modified surfaces display good features of osseointegration especially into the bone loss maxilla.