Restorative Dentistry

Current Awareness Newsletter

March 2016
Lunchtime Drop-in Sessions
January - June 2016

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Your Friendly Local Librarian...

Whatever your information needs, the library is here to help. We offer **literature searching services** as well as training and guidance in **searching the evidence** and **critical appraisal** – just email us at library@uhbristol.nhs.uk

**Outreach:** Your Outreach Librarian can help facilitate evidence-based practice for all in the restorative dentistry team, as well as assisting with academic study and research. We can help with **literature searching**, **obtaining journal articles and books**. We also offer one-to-one or small group training in **literature searching**, **accessing electronic journals**, and **critical appraisal**. Get in touch: library@uhbristol.nhs.uk

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UpToDate is the leading evidence-based clinical decision support system, designed for use at the point of care.

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- Adult and paediatric emergency medicine
- Allergy and immunology
- Cardiovascular medicine
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- Endocrinology and diabetes mellitus
- Family medicine
- Gastroenterology and hepatology
- General surgery
- Geriatrics
- Haematology
- Hospital Medicine
- Infectious diseases
- Nephrology and hypertension
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- Psychiatry
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**New from Up-to-Date**

**Gingivitis and periodontitis in adults: Classification and dental treatment**

*Authors*: Rebecca S Wilder, BSDH, MS; Antonio J Moretti, DDS, MS


**INTRODUCTION** — Periodontal, or gum disease is a common condition affecting the tissues that comprise the dental supporting structure: gingiva, cementum, periodontal ligament, and the alveolar bone (figure 1). Periodontal disease is broadly classified as either gingivitis or periodontitis; these conditions are distinguished by the presence of alveolar bone involvement that occurs with periodontitis, and not with gingivitis [1,2].

Periodontal disease may be a risk factor for a number of conditions including cardiovascular and pulmonary diseases, and pregnancies resulting in low birth weight [3-5]. Clinicians should encourage regular dental visits and incorporate oral examination into their office practice, inspecting for inflamed gingiva, bleeding, or suppuration around teeth.

This topic will review the classification of gingivitis and conditions associated with gingivitis and periodontitis. The pathogenesis, clinical manifestations, and antibiotic treatment of odontogenic infections are discussed in detail separately.

**Mandibular and palatal reconstruction in patients with head and neck cancer**

*Authors*: Barry L Wenig, MD, MPH; Michael R Zenn, MD, FACS


**INTRODUCTION** — Carcinoma of the head and neck can be treated and potentially cured by surgery, radiation therapy (RT), or a combined modality approach, which may also incorporate chemotherapy. The defects caused by surgical excision can cause significant problems in airway management, mastication, deglutition, speech, and cosmesis. In addition, RT has significant adverse effects upon wound healing that can complicate surgical management. (See "Management of late complications of head and neck cancer and its treatment".)

The goal of surgical reconstruction is to restore presurgical function and cosmesis. Optimization of the outcome of surgical reconstruction requires a team approach and should include speech pathology, physical therapy, and psychosocial support as appropriate.

The basic elements of mandibular reconstruction and palatal reconstruction will be reviewed here. The management of maxillary defects are discussed separately, as is rehabilitation for speech and swallowing defects.
On Twitter?

Twitter can be a useful CPD tool. Here are some accounts will help you stay on top of new developments in the Restorative Dentistry field:

- @BSPerio – the Twitter account for The British Society of Periodontology
- @BSSPD – the Twitter account for The British Society of Prosthodontics
- @BESTeethforlife – the Twitter account for The British Endodontic Society

What is OpenAthens?
OpenAthens is a way of authenticating that you have permission to access our subscription e-resources. To access our electronic resources you will need a UH Bristol Athens username/password.

How can I get an Athens login?
Click here to complete the online registration form. You will need to register using a Trust PC and a UH Bristol email address. Once you have successfully completed the form, you will be sent an email to you UH Bristol account with an authentication link.

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Password: If you are on a Trust PC, follow the link to https://register.athensams.net/nhs/forgotten_password.php.

Username and password: You should email athens.sdhc@nhs.net with your full name, full work address, work telephone number and the email address you used to register for the account. In the email subject line put ‘Forgotten username and password’. It may take up to five working days to receive your username and a reset password.
**New from the Dental Elf**

**Furcation involvement may double risk of tooth loss in periodontitis**

Feb 25 2016

Bone destruction as a result of periodontal disease in multi-rooted teeth can reach the point of root separation. This furcation involvement (FI) has been reported in between 30-50% of patients with periodontitis. Furcation defects are generally classified into degree I, II or III based on the horizontal component of the bony defect and teeth with furcation involvement are considered to have a poorer prognosis.

The aim of this review was to investigate risk of tooth loss in molars with furcation involvement (FI) based on initial diagnosis.

**Dental implants – immediate placement in infected sockets may increase failure rates**

Feb 19 2016

While implants have typically been placed in healed extraction socket there has been an increased interest in placing implants immediately into extraction sockets. Although animal studies have suggested there is no significant difference in success rates when placing implants in infected socket there is controversy regarding this procedure in human studies.

The aim of this review was to assess whether the immediate placement of dental implants into infected vs. non-infected sites changed the risk of implant failure and marginal bone loss.
Current Awareness Database Articles on Restorative Dentistry

Below is a selection of articles on restorative dentistry recently added to the healthcare databases, grouped in the following categories:

- Peri-implantitis
- Bisphosphonate-related osteonecrosis of the jaw
- Dental-related cleft lip and palate
- Periodontal disease and antibiotics
- Dental-related head and neck oncology
- Dental implants

If you would like any of the following articles in full text, or if you would like a more focused search on your own topic, then get in touch: library@uhbristol.nhs.uk

Peri-implantitis

Title: Histopathological Verification of Osteoimmunological Mediators in Peri-Implantitis and Correlation to Bone Loss and Implant Functional Period.

Citation: The Journal of oral implantology, Feb 2016, vol. 42, no. 1, p. 61-68, 1548-1336

Author(s): Konermann, Anna, Götz, Werner, Le, Michael, Dirk, Cornelius,

Abstract: Peri-implantitis (PI) is characterized by inflammation and bone resorption eventually leading to implant failure, but the characteristic pathologic determinants are undefined to date. This study aims to elucidate the parameters involved in PI pathogenesis, including intraoral implant retention time, extent of bone loss, smoking history, and identification of osteoimmunological markers for inflammation and bone loss. Peri-implant tissues (n = 21) displaying clinically diagnosed PI from patients with vertical bone loss ranging from 0-12 mm and implant function period between 1 and 60 months were evaluated by histochemistry and immunohistochemistry for TRAP, CD3, RANK, RANKL, OPG, and TNF-α. Statistical analyses were performed with the Welch test and correlation coefficients were calculated. Most bone resorption occurred during the first 12 months of implant function and correlated with the extent of inflammation, although histological signs of inflammation strongly varied between samples from minimal appearance of inflammatory cells to extended infiltrates. Implant function period and smoking history did not significantly affect the degree of inflammation. Higher RANK levels emerged in the first 12 months of implant function compared to longer retention times and were negatively correlated to the occurrence of RANKL. Additionally, histological signs of inflammation were
about two-fold higher in specimens with bone resorption up from 5 mm compared to under 5 mm. CD3(+) cells were more prevalent in extensive inflammatory infiltrates and samples derived from smokers. Our analyses proved that PI-induced bone loss is differentially influenced by the parameters evaluated in this study, but a distinct interconnection between disease severity and implant retention time can be established.

Title: Surgical Management of Severe Peri-Implantitis in the Esthetic Zone: A Case Report With a 6-Year Follow-Up.

Citation: The Journal of oral implantology, Feb 2016, vol. 42, no. 1, p. 86-92, 1548-1336

Author(s): Fu, Po-Sung, Wu, Yi-Min, Wang, Jen-Chyan, Huang, Ta-Ko, Chen, Wen-Cheng

Title: Conservative Implant Removal for the Analysis of the Cause, Removal Torque, and Surface Treatment of Failed Nonmobile Dental Implants.

Citation: The Journal of oral implantology, Feb 2016, vol. 42, no. 1, p. 69-77

Author(s): Anitua, Eduardo, Murias-Freijo, Alia, Alkhraisat, Mohammad Hamdan

Abstract: This study was performed to study the effect of implant surface treatment on the cause and removal torque of failed nonmobile implants. Implant explantation was achieved by the application of countertorque at the implant-bone interface. The explantation socket was examined carefully and curetted to remove any granulation tissue. Immediate implant placement was accomplished when primary stability could be achieved. Eighty-one patients were treated according to the described treatment protocol for the explantation of 158 nonmobile implants in the maxilla and the mandible. The patient's mean age was 62 ± 11 years. The main cause of implant explantation was peri-implantitis (131 implants; 82.9%) followed by malpositioning of the implants (22 implants; 13.9%). The explantation of 139 implants at 146 ± 5 Ncm was performed without the need for trephine bur. However, the use of trephine burs to cut into the first 3 to 4 mm was necessary in 19 explantations, and the removal torque was 161 ± 13 Ncm. All titanium plasma-sprayed implants were removed due to peri-implantitis at a significantly lower torque when compared to acid-etched, particle-blasted, and oxidized implants. The postoperative recovery of the patients was uneventful and the conservation of the available hard and soft tissues was successfully achieved. The protocol followed in this study could constitute a real alternative to other traumatic technique for the removal of failed implants and advanced stages of peri-implantitis. The type of implant surface treatment could influence the value of removal torque and the occurrence of peri-implantitis.

Title: Treatment of Refractory Apical Peri-Implantitis: A Case Report.

Citation: The Journal of oral implantology, Feb 2016, vol. 42, no. 1, p. 104-109

Author(s): Kutlu, Hüseyin Burak, Genc, Tolga, Tozum, Tolga Fikret
**Title:** Partial oxidation of TiN coating by hydrothermal treatment and ozone treatment to improve its osteoconductivity.

**Citation:** Materials science & engineering. C, Materials for biological applications, Feb 2016, vol. 59, p. 542-548, 1873-0191 (February 1, 2016)

**Author(s):** Shi, Xingling, Xu, Lingli, Le, Thi Bang, Zhou, Guanghong, Zheng, Chuanbo, Tsuru, Kanji, Ishikawa, Kunio

**Abstract:** Dental implants made of pure titanium suffer from abrasion and scratch during routine oral hygiene procedures. This results in an irreversible surface damage, facilitates bacteria adhesion and increases risk of peri-implantitis. To overcome these problems, titanium nitride (TiN) coating was introduced to increase surface hardness of pure titanium. However, the osteoconductivity of TiN is considered to be similar or superior to that of titanium and its alloys and therefore surface modification is necessary. In this study, TiN coating prepared through gas nitriding was partially oxidized by hydrothermal (HT) treatment and ozone (O3) treatment in pure water to improve its osteoconductivity. The effects of HT treatment and O3 treatment on surface properties of TiN were investigated and the osteoconductivity after undergoing treatment was assessed in vitro using osteoblast evaluation. The results showed that the critical temperature for HT treatment was 100°C since higher temperatures would impair the hardness of TiN coating. By contrast, O3 treatment was more effective in oxidizing TiN surfaces, improving its wettability while preserving its morphology and hardness. Osteoblast attachment, proliferation, alkaline phosphatase (ALP) expression and mineralization were improved on oxidized specimens, especially on O3 treated specimens, compared with untreated ones. These effects seemed to be consequences of partial oxidation, as well as improved hydrophilicity and surface decontamination. Finally, it was concluded that, partially oxidized TiN is a promising coating to be used for dental implant.

**Title:** Gingival Mesenchymal Stem Cell (GMSC) Delivery System Based on RGD-Coupled Alginate Hydrogel with Antimicrobial Properties: A Novel Treatment Modality for Peri-Implantitis.

**Citation:** Journal of prosthodontics : official journal of the American College of Prosthodontists, Feb 2016, vol. 25, no. 2, p. 105-115,

**Author(s):** Diniz, Ivana M A, Chen, Chider, Ansari, Sahar, Zadeh, Homayoun H,

**Abstract:** Peri-implantitis is one of the most common inflammatory complications in dental implantology. Similar to periodontitis, in peri-implantitis, destructive inflammatory changes take place in the tissues surrounding a dental implant. Bacterial flora at the failing implant sites resemble the pathogens in periodontal disease and consist of Gram-negative anaerobic bacteria including Aggregatibacter actinomycetemcomitans (Aa). Here we demonstrate the effectiveness of a silver lactate (SL)-containing RGD-coupled alginate hydrogel scaffold as a promising stem cell delivery vehicle with antimicrobial properties. Gingival mesenchymal stem cells (GMSCs) or human bone marrow mesenchymal stem cells (hBMMSCs) were encapsulated in SL-loaded alginate hydrogel microspheres. Stem cell viability, proliferation,
and osteo-differentiation capacity were analyzed. Our results showed that SL exhibited antimicrobial properties against Aa in a dose-dependent manner, with 0.50 mg/ml showing the greatest antimicrobial properties while still maintaining cell viability. At this concentration, SL-containing alginate hydrogel was able to inhibit Aa growth on the surface of Ti discs and significantly reduce the bacterial load in Aa suspensions. Silver ions were effectively released from the SL-loaded alginate microspheres for up to 2 weeks. Osteogenic differentiation of GMSCs and hBMMSCs encapsulated in the SL-loaded alginate microspheres were confirmed by the intense mineral matrix deposition and high expression of osteogenesis-related genes. Taken together, our findings confirm that GMSCs encapsulated in RGD-modified alginate hydrogel containing SL show promise for bone tissue engineering with antimicrobial properties against Aa bacteria in vitro.

**Bisphosphonate-related osteonecrosis of the jaw**

**Title:** Revival of nitrogen-containing bisphosphonate-induced inhibition of osteoclastogenesis and osteoclast function by water-soluble microfibrous borate glass.

**Citation:** Acta biomaterialia, Feb 2016, vol. 31, p. 312-325, 1878-7568

**Author(s):** Yuan, He, Niu, Li-Na, Jiao, Kai, Pei, Dan-Dan, Pramanik, Chandrani, Li, Ji-Yao,

**Abstract:** Bisphosphonate-related osteonecrosis of the jaw (BRONJ) is a serious skeletal complication associated with the long-term oral or intravenous use of nitrogen-containing bisphosphonates (N-BPs). Here, we investigated the effects of an ionic cocktail prepared from water-soluble microfibrous borate glass on neutralizing the inhibitory effects of two heterocyclic N-BPs, risedronate or zoledronic acid, on osteoclastogenesis, apoptosis of differentiated osteoclasts and osteoclast function. Cell growth and proliferation assays were first performed on RAW 264.7 cells to optimize the concentrations of the ionic cocktail and N-BPs to be used for static cell culture. The pre-osteoclasts were then stimulated with RANKL to differentiate into osteoclasts. The effects of the ionic cocktail and N-BPs on osteoclast differentiation, apoptosis and function were subsequently examined using 3 series of experiments conducted at the gene, protein, morphological and functional levels. After concentration optimization, the ionic cocktail was found to partially reverse N-BP-induced inhibition of osteoclastogenesis, stimulation of osteoclasts apoptosis and reduction of osteoclast resorptive activity. Ultrastructural examination of osteoclasts that had been exposed to either N-BP identified classical features of late apoptosis and secondary necrosis, while osteoclasts exposed simultaneously to the concentration-optimized ionic cocktail and N-BPs exhibited only signs of early apoptosis that were possibly reversible. Taken together, the results of the 4 series of experiments indicate that the ionic cocktail produced from dissolution of borate glass dressings has the potential to rescue the adverse effects of heterocyclic N-BPs on osteoclast differentiation and function. These results warrant further confirmation using dynamic cell culture and small animal BRONJ models. Long-term oral and intravenous use of nitrogen-containing bisphosphonates (N-BPs) may result in bisphosphonate-related osteonecrosis of the jaw (BRONJ) due to the suppression of normal bone turnover. There is no effective treatment for such a complication to date. This work
reported the use of an ionic cocktail derived from water-soluble microfibrous borate glass to revert heterocyclic N-BP-induced inhibition of osteoclastogenesis, stimulation of osteoclasts apoptosis and reduction of osteoclasts resorption in static cell culture condition. This ionic cocktail may have the potential to be further developed into a new adjunctive treatment for BRONJ.

**Title:** A mechanistic study of the interaction of water-soluble borate glass with apatite-bound heterocyclic nitrogen-containing bisphosphonates.

**Citation:** Acta biomaterialia, Feb 2016, vol. 31, p. 339-347,

**Author(s):** Pramanik, Chandrani, Sood, Parveen, Niu, Li-Na, Yuan, He, Ghoshal, Sushanta,

**Abstract:** Long-term oral and intravenous use of nitrogen-containing bisphosphonates (N-BPs) is associated with osteonecrosis of the jaw. Although N-BPs bind strongly to bone surfaces via non-covalent bonds, it is possible for extrinsic ions to dissociate bound N-BPs from mineralized bone by competitive desorption. Here, we investigate the effects and mechanism of using an ionic cocktail derived from borate bioactive glass for sequestration of heterocyclic N-BPs bound to apatite. By employing solid-state and solution-state analytical techniques, we confirmed that sequestration of N-BPs from bisphosphonate-bound apatite occurs in the presence of the borate-containing ionic cocktail. Simulations by density functional theory computations indicate that magnesium cation and borate anion are well within the extent of the risedronate or zoledronate anion to form precipitate complexes. The sequestration mechanism is due to the borate anion competing with bisphosphonates for similar electron-deficient sites on the apatite surface for binding. Thus, application of the borate-containing ionic cocktail represents a new topical lavage approach for removing apatite-bound heterocyclic N-BPs from exposed necrotic bone in bisphosphonate-related osteonecrosis of the jaw. Long-term oral consumption and injections of nitrogen-containing bisphosphonates (N-BPs) may result in death of the jaw bone when there is traumatic injury to the bone tissues. To date, there is no effective treatment for such a condition. This work reported the use of an ionic cocktail derived from water-soluble borate glass microfibers to displace the most potent type of N-BPs that are bound strongly to the mineral component on bone surfaces. The mechanism responsible for such an effect has been identified to be cation-mediated complexation of borate anions with negatively-charged N-BPs, allowing them to be released from the mineral surface. This borate-containing cocktail may be developed into a novel topical rinse for removing mineral-bound N-BPs from exposed dead bone.

**Title:** Hematopoietic Cell Transplantation in Patients with Medication-Related Osteonecrosis of the Jaws.

**Citation:** Biology of blood and marrow transplantation : journal of the American Society for Blood and Marrow Transplantation, Feb 2016, vol. 22, no. 2, p. 344-348,

**Author(s):** Mawardi, Hani, Glotzbecker, Brett, Richardson, Paul, Woo, Sook-Bin
**Abstract:** Patients with medication-related osteonecrosis of the jaw (MRONJ) are at risk for developing infections and often require long-term antimicrobial therapy for management. It is unclear whether patients with multiple myeloma (MM) who develop MRONJ experience increased morbidity when they undergo hematopoietic cell transplantation (HCT). The aim of this study was to characterize the course of HCT in MM patients with MRONJ. A retrospective chart review was conducted for patients with MM and MRONJ who underwent HCT between December 2005 and December 2014. Data collected included bisphosphonate use, MRONJ stage, positive blood cultures, number of febrile days, and length of hospital stay. Eleven patients (median age, 61; range, 46 to 71) fulfilled the criteria. Patients received zoledronic acid (72.7%), pamidronate (18.1%), or a combination of both (9%). At the time of HCT, 10 patients were in stage 1 MRONJ with 1 in stage 0. All patients had only mandibular involvement. No patient developed pain/infection at the MRONJ site during hospitalization. Bacteremia with positive blood cultures for Staphylococcus aureus occurred in 3 patients (27.2%), and 4 patients (36.3%) developed fever lasting between 4 to 6 days (of who 1 had positive blood cultures). The median length of hospital stay was 17 days (range, 7 to 22 days). These data suggests that patients with MM and MRONJ who undergo HCT are not at increased risk of developing symptoms associated with the MRONJ site or HCT-related infectious complications, and their MRONJ is not worsened by HCT.

**Title:** Denosumab-associated osteonecrosis of the jaw affects osteoclast formation and differentiation: Pathological features of two cases

**Citation:** Molecular and Clinical Oncology, February 2016, vol./is. 4/2(191-194)

**Author(s):** Matsushita Y., Hayashida S., Morishita K., Sakamoto H., Naruse T.,

**Abstract:** Medication-related osteonecrosis of the jaw (ONJ) is caused by antiresorptive (bisphosphonates and denosumab) and antiangiogenic agents, with the first report of denosumab-related ONJ emerging in 2010. To date, although certain case reports on denosumab-related ONJ have been published, those of ONJ caused by a single application of the drug are scarce. In addition, only one report described the histopathological features of this condition, although not completely; only the sequestrum resected by conservative surgery was evaluated. Although conservative treatment is recommended, the effectiveness of extensive surgery in the early stages of bisphosphonate-related ONJ has been described in recent years. Here we report the clinical and histopathological features of denosumab-related ONJ caused by single application of the drug, which was treated by extensive surgery in two patients. Histopathological analysis revealed a decreased number of osteoclasts in viable bone around the sequestrum, and these appeared morphologically immature, as indicated by the presence of very few nuclei. These findings are different from those for bisphosphonate-related ONJ and may assist in elucidating the mechanism underlying denosumab-related ONJ. Furthermore, extensive surgery may be effective for the management of this condition.
Cleft lip and palate

Title: Long-Term Computed Tomographic Evaluation of Alveolar Bone Formation in Patients with Unilateral Cleft Lip and Palate after Early Secondary Gingivoalveoloplasty.

Citation: Plastic and reconstructive surgery, Feb 2016, vol. 137, no. 2, p. 365e,

Author(s): Meazzini, Maria Costanza, Corno, Martina, Novelli, Giorgio, Autelitano,

Abstract: The goal of this study was to evaluate with a three-dimensional method the long-term quality of alveolar ossification in unilateral cleft lip and palate patients who underwent early secondary gingivoalveoloplasty according to the Milan surgical protocol. The sample consisted of 63 computed tomographic scans of unilateral cleft lip and palate patients in permanent dentition. The average age at the time of assessment was 15.7 years. Alveolar thickness, nasoalveolar height, nasal floor ossification, and hard palate morphology were evaluated using dental, axial, and coronal cuts on computed tomographic scans and three-dimensional models. All measurements were normalized and ratios of the affected side versus the nonaffected side were provided. Volume measurements and ratios of each hemimaxilla were added. The presence or absence of the permanent lateral incisor on the cleft side was also recorded. Alveolar thickness and height were ideal or good, respectively, in 89.5 and 91.4 percent of the sample. Insufficient ossification (<25 percent) was found in three patients (5.2 percent), and only one of them (1.7 percent) presented no bone bridging. A statistically significant association was detected between the degree of alveolar ossification, the type of nasal floor ossification, and volume ratio. Early secondary gingivoalveoloplasty seemed to allow an adequate ossification of both the alveolar and nasal region. Three-dimensional evaluation of the alveolar cleft ossification provided further information on alveolar bridging and allowed evaluation of the bone availability for implant placement. Therapeutic, IV.


Citation: Journal of cranio-maxillo-facial surgery : official publication of the European Association for Cranio-Maxillo-Facial Surgery, Feb 2016, vol. 44, no. 2, p. 94-103,

Author(s): Dissaux, Caroline, Grollemund, Bruno, Bodin, Frédéric, Picard, Arnaud,

Abstract: Cleft surgery is marked by all the controversies and the multiplication of protocols, as it has been shown by the Eurocleft study. The objective of this pilot study is to start a comparison and analyzing procedure between primary surgical protocols in French centers. Four French centers with different primary surgical protocols for cleft lip and palate repair, have accepted to be involved in this retrospective study. In each center, 20 consecutive patients with complete cleft lip and palate (10 UCLP, 10 BCLP per center), non syndromic, have been evaluated at a mean age of 5 [range, 4-6]. In this second part, maxillary growth and palatine morphology were assessed on clinical examination and on dental casts (Goslon score). Speech was also evaluated clinically (Borel-maisonny classification) and by Aerophonescope. Veau-Wardill-Killner palatoplasty involves a higher rate of transversal
maxillary deficiency and retromaxillary. The fistula rate is statistically lower with tibial periosteum graft hard palate closure but this technique seems to give retromaxillary. Malek and Talmant two-stage-palatoplasty techniques reach Goslon scores of 1 or 2. Considering speech, Sommerlad intravelar veloplasty got higher outcomes. Primary results. Extension to other centers required. The two-stage palatoplasty, including a Sommerlad intravelar veloplasty seems to have the less negative impact on maxillary growth, and to give good speech outcomes. Therapeutic study. Level III/retrospective multicenter comparative study.

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**Periodontal disease and antibiotics**

No new evidence this month

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**Head and neck oncology and dentistry**

**Title:** No role for human papillomavirus infection in oral cancers in a region in southern India

**Citation:** International Journal of Cancer, February 2016, vol./is. 138/4(912-917)

**Author(s):** Laprise C., Madathil S.A., Allison P., Abraham P., Raghavendran A., Shahul H.P.

**Abstract:** Oral cancer is a major public health issue in India with ~77,000 new cases and 52,000 deaths yearly. Paan chewing, tobacco and alcohol use are strong risk factors for this cancer in India. Human papillomaviruses (HPVs) are also related to a subset of head and neck cancers (HNCs). We examined the association between oral HPV and oral cancer in a sample of Indian subjects participating in a hospital-based case-control study. We recruited incident oral cancer cases (N = 350) and controls frequency-matched by age and sex (N = 371) from two main referral hospitals in Kerala, South India. Sociodemographic and behavioral data were collected by interviews. Epithelial cells were sampled using Oral CDx brushes from the oral cancer site and the normal mucosa. Detection and genotyping of 36 HPV genotypes were done using a polymerase chain reaction protocol. Data collection procedures were performed by qualified dentists via a detailed protocol with strict quality control, including independent HPV testing in India and Canada. HPV DNA was detected in none of the cases or controls. Associations between oral cancer and risk factors usually associated with HPV infection, such as oral sex and number of lifetime sexual partners, were examined by logistic regression and were not associated with oral cancer. Lack of a role for HPV infection in this study may reflect cultural or religious characteristics specific to this region in India that are not conducive to oral HPV transmission. A nationwide representative prevalence study is needed to investigate HPV prevalence variability among Indian regions. What’s new? A new study out of southern India shows that HPV is not the culprit behind the widespread oral cancer in that region. Recently, HPV has been implicated in HNC cases worldwide, and may be responsible for a burgeoning epidemic. Because oral cancer is so prevalent in southern India, the authors wanted to know whether the virus plays a role, especially because an HPV vaccine is available. When they tested for 36 HPV subtypes in...
oral cancer cases and controls, however, they found no HPV DNA in any of the individuals.

Dental implants

Title: A strontium-incorporated nanoporous titanium implant surface for rapid osseointegration.

Citation: Nanoscale, Feb 2016, vol. 8, no. 9, p. 5291-5301,

Author(s): Zhang, Wenjie, Cao, Huiliang, Zhang, Xiaochen, Li, Guanglong, Chang, Qing

Abstract: Rapid osseointegration of dental implants will shorten the period of treatment and enhance the comfort of patients. Due to the vital role of angiogenesis played during bone development and regeneration, it might be feasible to promote rapid osseointegration by modifying the implant surface to gain a combined angiogenesis/osteogenesis inducing capacity. In this study, a novel coating (MAO-Sr) with strontium-incorporated nanoporous structures on titanium implants was generated via a new micro-arc oxidation, in an attempt to induce angiogenesis and osteogenesis to enhance rapid osseointegration. In vitro, the nanoporous structure significantly enhanced the initial adhesion of canine BMSCs. More importantly, sustained release of strontium ions also displayed a stronger effect on the BMSCs in facilitating their osteogenic differentiation and promoting the angiogenic growth factor secretion to recruit endothelial cells and promote blood vessel formation. Advanced mechanism analyses indicated that MAPK/Erk and PI3K/Akt signaling pathways were involved in these effects of the MAO-Sr coating. Finally, in the canine dental implantation study, the MAO-Sr coating induced faster bone formation within the initial six weeks and the osseointegration effect was comparable to that of the commercially available ITI implants. These results suggest that the MAO-Sr coating has the potential for future use in dental implants.

Title: Enhanced Osseointegration of Hierarchical Micro/Nanotopographic Titanium Fabricated by Microarc Oxidation and Electrochemical Treatment.

Citation: ACS applied materials & interfaces, Feb 2016, vol. 8, no. 6, p. 3840-3852,

Author(s): Li, Guanglong, Cao, Huiliang, Zhang, Wenjie, Ding, Xun, Yang, Guangzheng

Abstract: Rapid osseointegration is recognized as a critical factor in determining the success rate of orthopedic and dental implants. Microarc oxidation (MAO) fabricated titanium oxide coatings with a porous topography have been proven to be a potent approach to enhance osteogenic capacity. Now we report two kinds of new hierarchical coatings with similar micromorphologies but different nanotopographies (i.e., MAO and MAO-AK coatings), and both coatings significantly promote cell attachment and osteogenic differentiation through mediating the integrin β1 signaling pathway. In this study, titanium with a unique hierarchical micro/nanomorphology surface was fabricated by a novel duplex coating process, that is, the first a titanium oxide layer was coated by MAO, and then the coating
was electrochemically reduced in alkaline solution (MAO-AK). A series of in vitro stem cell differentiation and in vivo osseointegration experiments were carried out to evaluate the osteogenic capacity of the resulting coatings. In vitro, the initial adhesion of the canine bone marrow stem cells (BMSCs) seeded on the MAO and MAO-AK coatings was significantly enhanced, and cell proliferation was promoted. In addition, the expression levels of osteogenesis-related genes, osteorix, alkaline phosphates (ALP), osteopontin, and osteocalcin, in the canine BMSCs, were all up-regulated after incubation on these coatings, especially on the MAO-AK coating. Also, the in vitro ALP activity and mineralization capacity of canine BMSC cultured on the MAO-AK group was better than that on the MAO group. Furthermore, 6 weeks after insertion of the titanium implants into canine femurs, both the bone formation speed and the bone-implant contact ratio of the MAO-AK group were significantly higher than those of the MAO group. All these results suggest that this duplex coating process is promising for engineering titanium surfaces to promote osseointegration for dental and orthopedic applications.

Title: Removal techniques for failed implants.

Citation: British dental journal, Feb 2016, vol. 220, no. 3, p. 109-114,

Author(s): Bowkett, A, Laverty, D, Patel, A, Addy, L

Abstract: The use of dental implants is an accepted and predictable way of replacing missing or lost teeth. However, implants can and will fail and there are a variety of reasons why this occurs, which the practitioner should understand. In some instances failed implants may require removal and, therefore, practitioners should be aware of techniques that can be used to remove failed implants to potentially enable future rehabilitation of an edentulous region.

Title: Periodic Nanoneedle and Buffer Zones Constructed on a Titanium Surface Promote Osteogenic Differentiation and Bone Calcification In Vivo.

Citation: Advanced healthcare materials, Feb 2016, vol. 5, no. 3, p. 364-372

Author(s): Yu, Peng, Zhu, Xiaojing, Wang, Xiaolan, Wang, Shuangying, Li, Weiping, Tan,

Abstract: Rapid and effective bone mineralization at the bone/implant interface is required for successful orthopedic and dental implants. In this study, two periodic microscale functionalized zones on titanium (MZT) are created, namely, nanoneedle zones and buffer zones. The aim of this design is to provide spatially regulated topographical cues on titanium to enhance the efficacy of bone regeneration. This goal is achieved using a versatile and effective technique in which nanoneedle structures are hydrothermally constructed on the surface of titanium sheets, after which selective laser irradiation is used to construct buffer zones. The zonal structures of the MZT overcome the suppressive effect of the nanoneedle film on osteoblasts. Additionally, the MZT exhibits zone-selective apatite deposition and protein adsorption. The accelerated in vitro osteoblast differentiation and nodule deposition on the MZT are confirmed. Elemental analysis of the bone nodules formed by the osteoblasts growing on the titanium and MZT demonstrates they have different
compositions. Histological and scanning electron microscope analysis of the bone formation on in vivo implants shows that this process is also enhanced by the MZT implant. The concept of constructing functionalized zones on titanium implant could facilitate future research on improving the design of orthopedic and dental implant surfaces.

Title: Vertical Bone Augmentation with an Autogenous Block or Particles in Combination with Guided Bone Regeneration: A Clinical and Histological Preliminary Study in Humans.

Citation: Clinical implant dentistry and related research, Feb 2016, vol. 18, no. 1, p. 19-29,

Author(s): Rocchietta, Isabella, Simion, Massimo, Hoffmann, Maria, Trisciuoglio, Davide,

Abstract: Vertical ridge augmentation with the use of solid bone blocks or particulate bone autograft, exposed or covered by a nonresorbable expanded polytetrafluoroethylene (ePTFE) membrane, are well known in the literature and have been shown to be effective in treating bone atrophy. The aim of our study was to assess the two techniques in respect to biological properties of transplanted bone in graft revascularization and bone remodeling in conjunction with dental implants. Ten patients were treated within the study, with a total of 12 sites with posterior mandibular edentulous ridges with insufficient bone to allow implant placement. Bone regeneration was performed using autogenous intraoral block graft or autogenous particulate graft with an ePTFE barrier membrane. At 6-10 months, reentry surgery was performed; bone biopsies, including microscrews, were harvested; and implants were placed. Eleven sites out of 12 healed unevenly. A mean height gain of 5.03 mm was achieved. Mean bone-to-implant contact and bone fill were assessed by means of histomorphometric analysis. The block specimens revealed a bone-to-implant contact of 42.34%, and the particulate grafts had a bone-to-implant contact of 26.62% (p < .012). Bone fill values reported were 68.32% and 48.28% (p < .019) for block specimens versus particulate grafts. The results clearly showed that both techniques were clinically successful for subsequent implant placement and prosthetic rehabilitation. The histological outcomes, including revascularization and bone remodeling, of the two techniques differed significantly. The block grafts outperformed the particulate grafts in terms of bone-to-implant contact and bone fill values; however, the morbidity associated with the donor site of the block must be considered.

Title: Displacement of Dental Implants Into the Maxillary Sinus: A Retrospective Study of Twenty-One Patients.

Citation: Clinical implant dentistry and related research, Feb 2016, vol. 18, no. 1, p. 62-72,

Author(s): Sgaramella, Nicola, Tartaro, Gianpaolo, D'Amato, Salvatore, Santagata, Mario, Colella, Giuseppe

Abstract: One possible complication of implant surgery in the posterior maxilla is the displacement of implants into the maxillary sinus. To report on clinical and radiological findings and on biological, surgical, and biomechanical considerations in cases of implant displacement. This is a retrospective study of 21 patients referred to the Department of Head and Neck Surgery, Second University of Naples, due to implants displaced into the
maxillary sinus. Patient, implant, and treatment data were collected, and 1-year follow-up was made. A total of 24 displaced implants were diagnosed and surgically removed through an antrostomy in the lateral sinus wall. Implant displacement occurred after functional loading in only one case; in the remaining cases, displacement occurred either perioperatively or postoperatively prior to loading. Besides the displacement, eight patients suffered from maxillary sinusitis, treated with a Caldwell-Luc operation. Healing was uneventful for all patients, and no sinusitis relapse or late postoperative complication was present at 1-year follow-up. It is reasonable to affirm that the major cause of displacement of implants is related, most of the time, to incorrect treatment planning and/or a poorly performed surgical procedure. When implant displacement occurs, the displaced foreign body has to be removed in order to avoid sinus pathology.

Title: Bacterial Colonization of the Implant-Abutment Interface (IAI) of Dental Implants with a Sloped Marginal Design: An in vitro Study.

Citation: Clinical implant dentistry and related research, Feb 2016, vol. 18, no. 1, p. 161-167.

Author(s): Koutouzis, Theofilos, Gadalla, Hana, Lundgren, Tord

Abstract: The aim of this study is to utilize an in vitro dynamic loading model to assess the potential risk of bacterial invasion into the Implant Abutment Interface (IAI) microgap of dental implants with sloped marginal design. Forty implants were divided into two groups (\(n = 20\) per group) based on implant marginal design. Group 1 was comprised of implants with Morse-taper connection and conventional marginal design that connected to titanium abutments. Group 2 was comprised of implants with Morse-taper connection and sloped marginal design that connected to titanium abutments. The specimens were immersed in a bacterial solution of E. coli and loaded with 500,000 cycles of 160N using a chewing simulator. Following disconnection of fixtures and abutments, microbial samples were taken from the threaded portion of the abutment, plated and cultured under appropriate conditions. Ten out of twenty implants of Group 1 and eight out of twenty implants of Group 2 had IAI microgaps colonized by E. Coli. There was not a statistically significant difference in the mean number of E. Coli CFU detected between implants of Group 1 (mean 19.2, SD 23.6) and Group 2 (mean 12.5, SD18.9) (\(p > .05\)). The present study demonstrated that implants with a sloped marginal design exhibited similar risk for bacterial invasion into the IAI microgap under in vitro dynamic loading conditions compared to implants with conventional marginal design.

Title: Analyzing the Influence of a New Dental Implant Design on Primary Stability.

Citation: Clinical implant dentistry and related research, Feb 2016, vol. 18, no. 1, p. 168-173

Author(s): da Costa Valente, Mariana Lima, de Castro, Denise Tornavoi, Shimano

Abstract: The macrogeometry of dental implants strongly influences the primary stability and hence the osseointegration process. Compare the performance of conventional and modified implant models in terms of primary stability. A total of 36 implants (Neodent®) with two different formats (\(n = 18\)): Alvim CM (Conical CM, \(\varnothing 4.3 \text{ mm} \times 10 \text{ mm in length}\))
and Titamax Ti (Cylindrical HE, Ø 4.0 mm × 11 mm in length) were inserted into artificial bone blocks. Nine implants from each set were selected to undergo external geometry changes. The primary stability was quantified by insertion torque and resonance frequency using an Osstell device and the pullout test. One-way analysis of variance and Tukey's test were used for statistical evaluation. The comparative analysis of the implants showed a significant increase of the insertion torque for the modified Conical CM implants (p = 0.000) and Cylindrical HE (p = 0.043); for the resonance frequency the modified Cylindrical HE showed a lower statistical mean (p = 0.002) when compared to the conventional model, and in the pullout test both modified implants showed significant reduction (p = 0.000). Within the limitations of this study, the proposed modification showed good stability levels and advantages when compared to the conventional implants. © 2015 Wiley Periodicals, Inc.

Title: Influence of the Periodontal Status on the Initial-Biofilm Formation on Titanium Surfaces.

Citation: Clinical implant dentistry and related research, Feb 2016, vol. 18, no. 1, p. 174-181

Author(s): Martínez-Hernández, Miryam, Olivares-Navarrete, René,

Abstract: Dental implants will be exposed to a complex ecosystem once they are placed in the oral cavity. The bacterial colonization and biofilm formation on these devices will depend not only on the physicochemical surface implant properties but also on the periodontal health conditions of the patients, as these devices are exposed. The aim of this study was to correlate the subgingival microbial profile with the composition of initial biofilm formed on different microstructured titanium (Ti) surfaces. Ten periodontitis and 10 periodontally healthy subjects were included in this study. The subjects wore a removable acrylic device with four different fixed Ti surfaces for 48 hours. Microbial samples of subgingival plaque and the biofilm formed on each Ti surface were individually analyzed by the checkerboard DNA-DNA hybridization technique. Despite the roughness or hydrophilicity of the Ti surfaces, a characteristic pattern of bacterial adhesion was observed on each of the study groups. However, significant differences in the proportion of the species that colonized the Ti surfaces were found between the periodontitis and periodontally healthy groups. Treponema denticola, Neisseria mucosa, Eikenella corrodens, and Tannerella forsythia were detected in higher proportions on the Ti disks placed in the periodontitis subjects, while significant higher proportions of Capnocytophaga sputigena, Fusobacterium periodonticum, Prevotella melaninogenica, and Streptococcus mitis were detected on the Ti disks placed in the periodontally healthy group. The results obtained in this study shows that the composition and the proportion of the species that initially colonize Ti surfaces are highly influenced by the periodontal status more than the surface characteristics of the Ti implant.

Title: Surface micro-structuring of zirconia dental implants.

Citation: Clinical oral implants research, Feb 2016, vol. 27, no. 2, p. 162-166,

Author(s): Fischer, J, Schott, A, Märtin, S
**Abstract:** Sandblasting with subsequent acid etching is a potential procedure to generate microstructured surfaces on zirconia implants. The aim of the study was to systematically analyze the effect of these process steps on surface morphology and mechanical strength of the implants. Zirconia implant blanks (ceramic implant, VITA) were sandblasted (105-μm alumina, 6 bar), subsequently HF-etched, and finally heat-treated at 1250°C. Surface topographies were documented by SEM. Surface roughness Ra (n = 4), monoclinic volume fraction in the surface layer (n = 1), and static fracture load (n = 4) were measured. Surface roughness Ra reached a maximum of 1.2 μm after 4× sandblasting. Scratches and sharp edges dominated the surface aspect. Fracture load increased with the number of sandblasting cycles with a gain of 30% after 20 cycles. HF etching did not change the Ra values, but sharp edges were rounded and small pits created. A minor decrease in fracture load with increasing etching time was observed. Heat treatment of 1 h reduced the fracture load by 1/3. Longer heat treatment had no further effect. The roughness Ra was not modified by heat treatment. Fracture load was strongly correlated with the monoclinic fraction except for the results obtained directly after acid etching, where a constant monoclinic fraction was observed. Sandblasting with 105-μm alumina followed by 1 h HF etching at room temperature and 1 h heat treatment at 1250°C is a reliable and tolerant process to create a surface roughness of about Ra = 1.2 μm on zirconia implants.

**Title:** Microbiota at teeth and implants in partially edentulous patients. A 10-year retrospective study.

**Citation:** Clinical oral implants research, Feb 2016, vol. 27, no. 2, p. 218-225,

**Author(s):** Eick, Sigrun, Ramseier, Christoph A, Rothenberger, Kathrin, Brägger, Urs,

**Abstract:** To determine the microbiota at implants and adjacent teeth 10 years after placement of implants with a sandblasted and acid-etched surface. Plaque samples obtained from the deepest sites of 504 implants and of 493 adjacent teeth were analyzed for certain bacterial species associated with periodontitis, for staphylococci, for aerobic gram-negative rods, and for yeasts using nucleic acid-based methods. Species known to be associated with periodontitis were detectable at 6.2-78.4% of the implants. Significantly higher counts at implants in comparison with teeth were assessed for Tannerella forsythia, Parvimonas micra, Fusobacterium nucleatum/necrophorum, and Campylobacter rectus. Higher counts of periodontopathogenic species were detectable at implants of current smokers than at those of non-smokers. In addition, those species were found in higher quantities at implants of subjects with periodontitis. The prevalence of Prevotella intermedia, Treponema denticola, C. rectus, and moreover of Staphylococcus warneri might be associated with peri-implant inflammation. Selected staphylococcal species (not Staphylococcus aureus), aerobic gram-negative rods, and yeasts were frequently detected, but with the exception of S. warneri, they did not show any association with periodontal or peri-implant diseases. Smoking and periodontal disease are risk factors for colonization of periodontopathic bacteria at implants. Those bacterial species may play a potential role in peri-implant inflammation. The role of S. warneri needs further validation.

**Title:** Perioperative use of non-steroidal anti-inflammatory drugs might impair dental implant osseointegration.
Citation: Clinical oral implants research, Feb 2016, vol. 27, no. 2, p. e1.,

Author(s): Winnett, Brent, Tenenbaum, Howard C, Ganss, Ben, Jokstad, Asbjørn

Abstract: To appraise whether adverse biological events following oral implant placement may be associated with perioperative use of non-steroidal anti-inflammatory drugs (NSAIDs). All patients treated in a university faculty postgraduate dental clinic between 1979 and 2012 that had experienced a failing and surgically removed dental implant (292 implants in 168 patients) were contacted to solicit additional information about their present dental and medical status and frequency of current and past use of NSAIDs. Potential associations between perioperative NSAIDs use and the occurrence of adverse biological events were explored by the use of $2 \times 2$ tables and two-tailed Fisher’s exact tests. One hundred and four patients with initially 468 implants had experienced 238 implant failures, of which 197 were due to failing osseointegration (42%). Sixty of the participants, initially with 273 implants, had used NSAIDs perioperatively and experienced 44% implant failures, versus 38% in the non-NSAID cohort. The NSAID cohort experienced 3.2 times more cases of radiographic bone loss greater than 30% of the vertical height of their remaining implants and 1.9 times more cases of cluster failures, defined as failure of 50% or more of the implant(s) placed. Notwithstanding that a retrospective study design is open to potential bias, the current data indicate that dental implant osseointegration may be affected negatively by an inhibitory effect of NSAIDs on bone healing in vulnerable patients. Future and better clinical studies than the current should be designed to appraise more precisely the potential effects of NSAIDs on implant osseointegration in study populations that are not limited by stringent medical inclusion and exclusion criteria.

Title: Crestal bone resorption in augmented bone using mineralized freeze-dried bone allograft or pristine bone during submerged implant healing: a prospective study in humans.

Citation: Clinical oral implants research, Feb 2016, vol. 27, no. 2, p. e25.,

Author(s): Huang, Hsiang-Yun, Ogata, Yumi, Hanley, James, Finkelman, Matthew, Hur, Yong

Abstract: There is limited evidence on the crestal bone level changes around implants placed in bone augmented by guided bone regeneration (GBR) during submerged healing. The purpose of this study was to prospectively compare radiographic crestal bone changes around implants placed in augmented bone with changes around implants placed in pristine bone. Patients receiving dental implants in the augmented or pristine mandibular posterior edentulous ridge were included in the study. The digital standardized radiographs from the implant placement procedure were compared to the radiographs from the second-stage procedure to evaluate the peri-implant marginal bone level changes. The soft tissue thickness (ST), width of keratinized mucosa (wKM), and early cover screw exposure (eIE) were measured at the time of the second-stage procedure. A total of 29 implants in 26 patients, 11 in augmented bone (test group) and 18 in pristine bone (control group), were analyzed. The mean peri-implant bone loss ($\Delta$BL) was $0.74 \pm 0.74$ mm (mean $\pm$ SD) in the test group and $0.25 \pm 0.55$ mm (mean $\pm$ SD) in the control group. The differences between the test and control groups in the mesial, distal, and mean peri-implant crestal bone level
changes were statistically significant ($P = 0.009$, $P = 0.004$, and $P = 0.001$, respectively). The confounding factors (ST, wKM, and eIE) were adjusted. More peri-implant crestal bone loss during the submerged healing period was observed in augmented bone than in pristine bone. Augmented bone may not exhibit the same characteristics as pristine bone during the implant submerged healing period.

**Title:** Comparison of fixed implant-supported prostheses, removable implant-supported prostheses, and complete dentures: patient satisfaction and oral health-related quality of life.

**Citation:** Clinical oral implants research, Feb 2016,

**Author(s):** Oh, Sung-Hee, Kim, Younhee, Park, Joo-Yeon, Jung, Yea Ji, Kim, Seong-Kyun,

**Abstract:** The purpose of this study was to compare patient satisfaction and oral health-related quality of life (OHRQoL) among fully edentulous patients treated with either fixed implant-supported prostheses (FP), removable implant-supported prostheses (RP), or complete dentures (CD). Eighty-six patients - 29 FP, 27 RP, and 30 CD patients - participated in this study. The survey was conducted using face-to-face interviews with a questionnaire that included a patient satisfaction scale and Oral Health Impact Profile (OHIP-14). We measured patient satisfaction after prosthetic treatments and OHRQoL before and after the treatments. After prosthetic treatments, OHRQoL increased in all three groups ($P < 0.05$). The FP and RP groups showed no significant difference in patient satisfaction and OHRQoL, and both groups showed greater improvement compared with the CD group. Specifically, the OHRQoL dimensions of functional limitation, physical pain, psychological discomfort, and psychological disability in the FP group, and functional limitation in the RP group, improved greatly in comparison with the CD group ($P < 0.05$). Although further research is still needed, prosthetic treatments may provide superior OHRQoL for fully edentulous patients. In particular, both the FP and RP treatments provided significantly greater improvement of OHRQoL and patient satisfaction than the CD treatment. Reliable information of OHRQoL and patient satisfaction helps experts and patients choose the best prosthetic treatment option.

**Title:** What is the impact of bisphosphonate therapy upon dental implant survival? A systematic review and meta-analysis.

**Citation:** Clinical oral implants research, Feb 2016, vol. 27, no. 2, p. e38.,

**Author(s):** Ata-Ali, Javier, Ata-Ali, Fadi, Peñarrocha-Oltra, David, Galindo-Moreno, Pablo

**Abstract:** A systematic review and meta-analysis are carried out to assess the scientific evidence that bisphosphonate therapy can decrease the success rate of dental implants. The PubMed (Medline) database was used to search for articles published up until February 22, 2014. The meta-analysis was conducted based on the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA). The Newcastle-Ottawa scale (NOS) was used to assess study quality. The combinations of search terms resulted in a list of 256 titles. Fourteen finally met the inclusion criteria and were thus selected for inclusion in the
systematic review. Eight studies (six retrospective and two prospective) were included in the meta-analysis, with a total of 1288 patients (386 cases and 902 controls) and 4562 dental implants (1090 dental implants in cases and 3472 in controls). The summary odds ratio (OR = 1.43, P = 0.156) indicates that there is not enough evidence that bisphosphonates have a negative impact upon implant survival. According to the number need to harm (NNH), over 500 dental implants are required in patients receiving bisphosphonate treatment to produce a single implant failure. Our results show that dental implant placement in patients receiving bisphosphonates does not reduce the dental implant success rate. On the other hand, such patients are not without complications, and risk evaluation therefore must be established on an individualized basis, as one of the most serious though infrequent complications of bisphosphonate therapy is bisphosphonate-related osteonecrosis of the jaws. Given the few studies included in our meta-analysis, further prospective studies involving larger sample sizes and longer durations of follow-up are required to confirm the results obtained.

**Title:** Immediate vs. delayed loading in the posterior mandible: a split-mouth study with up to 15 years of follow-up.

**Citation:** Clinical oral implants research, Feb 2016, vol. 27, no. 2, p. e74.,

**Author(s):** Romanos, Georgios E, Aydin, Erhan, Locher, Kathrin, Nentwig, Georg-Hubertus

**Abstract:** The aim of this study was to evaluate the long-term clinical and radiographic outcomes of implants that were immediately loaded in a prospective, randomized, split-mouth clinical trial in the posterior mandible. Patients with alveolar ridges that were bilaterally edentulous distal to the canines were enrolled to participate. On one randomly selected side of each patient's jaw, three implants (control group) with platform switching and a progressive thread design were placed, allowed to heal for 3 months, uncovered, and loaded occlusally using resin-splinted crowns, which then were replaced 6 weeks later by final prostheses. Three additional implants (test group) of the same size and design were placed on the contralateral side of each patient in symmetrical locations. The test implants were connected to their final abutments immediately after placement and immediately loaded. Periodontal indices and bone loss were evaluated at regular intervals. After a mean loading period of 12.14 (±0.89) years for the test group and 12.40 (±0.89) years for controls, differences between the immediately and delayed loaded implants were not statistically significant (P > 0.05). The crestal bone loss was (mesial) 0.70 (±1.09) mm (test group) and 1.17 (±1.27) mm (control group) and the distal bone loss was 0.43 (±1.02) mm (test group) and 1.06 (±1.33) mm (control group) (P > 0.05). The maximum crestal bone loss was 3.12 mm for the test group and 3.78 mm for the controls after 10.125/10.397 years, respectively. Immediate loading does not negatively influence the long-term prognosis of dental implants in the posterior mandible, improves the implant stability, and is associated with minimal crestal bone loss when platform switching and a one-abutment concept with a Morse-tapered connection are used.

**Title:** Impact of implant support on mandibular free-end base removable partial denture: theoretical study.

Author(s): Oh, Won-Suk, Oh, Tae-Ju, Park, Ju-Mi

Abstract: This study investigated the impact of implant support on the development of shear force and bending moment in mandibular free-end base removable partial dentures (RPDs). Three theoretical test models of unilateral mandibular free-end base RPDs were constructed to represent the base of tooth replacement, as follows: Model 1: first and second molars (M1 and M2); Model 2: second premolar (P2), M1, and M2; and Model 3: first premolar (P1), P2, M1, and M2. The implant support located either at M1 or M2 sites. The occlusal loading was concentrated at each replacement tooth to calculate the stress resultants developed in the RPD models using the free-body diagrams of shear force and bending moment. There was a trend of reduction in the peak shear force and bending moment when the base was supported by implant. However, the degree of reduction varied with the location of implant support. The moment reduced by 76% in Model 1, 58% in Model 2, and 42% in Model 3, when the implant location shifted from M1 to M2 sites. The shear forces and bending moments subjected to mandibular free-end base RPDs were found to decrease with the addition of implant support. However, the impact of implant support varied with the location of implant in this theoretical study.

Implant dentistry, Feb 2016, vol. 25, no. 1, p. 32-38

Author(s): Kanayama, Takeo, Horii, Koichiro, Senga, Yasuko, Shibuya, Yasuyuki

Abstract: Platelet-rich fibrin (PRF) has been recently used as the sole grafting material in sinus floor elevation procedures. The aim of this prospective study was to measure the bone gain around the dental implant after using the crestal approach to sinus floor elevation using platelet-rich fibrin as the only grafting material in atrophic posterior maxillae with residual bone height <5 mm. Two different types of implants were used: hydroxyapatite (HA) and sandblasted acid-etched (SA) implants. Panoramic radiography and computed tomography were used to measure the endosinus bone gain. Twenty-seven patients with 39 implants (19 HA and 20 SA) were included in this study. The mean residual bone measurements before surgery in the SA and HA groups were 2.85 and 2.68 mm, respectively. The mean average bone gains for 1 year in the SA and HA groups were 4.38 and 4.00 mm, respectively. This prospective study showed that platelet-rich fibrin promoted endosinus bone gain when used as the grafting material in the crestal approach to sinus floor elevation.

Implant dentistry, Feb 2016, vol. 25, no. 1, p. 39-46

Author(s): Kanayama, Takeo, Horii, Koichiro, Senga, Yasuko, Shibuya, Yasuyuki

Abstract: Platelet-rich fibrin (PRF) has been recently used as the sole grafting material in sinus floor elevation procedures. The aim of this prospective study was to measure the bone gain around the dental implant after using the crestal approach to sinus floor elevation using platelet-rich fibrin as the only grafting material in atrophic posterior maxillae with residual bone height <5 mm. Two different types of implants were used: hydroxyapatite (HA) and sandblasted acid-etched (SA) implants. Panoramic radiography and computed tomography were used to measure the endosinus bone gain. Twenty-seven patients with 39 implants (19 HA and 20 SA) were included in this study. The mean residual bone measurements before surgery in the SA and HA groups were 2.85 and 2.68 mm, respectively. The mean average bone gains for 1 year in the SA and HA groups were 4.38 and 4.00 mm, respectively. This prospective study showed that platelet-rich fibrin promoted endosinus bone gain when used as the grafting material in the crestal approach to sinus floor elevation.

Effect of Induced Periimplantitis on Dental Implants With and Without Ultrathin Hydroxyapatite Coating.

Implant dentistry, Feb 2016, vol. 25, no. 1, p. 39-46

Author(s): Kanayama, Takeo, Horii, Koichiro, Senga, Yasuko, Shibuya, Yasuyuki

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Title: Effect of Induced Periimplantitis on Dental Implants With and Without Ultrathin Hydroxyapatite Coating.

Citation: Implant dentistry, Feb 2016, vol. 25, no. 1, p. 39-46
Author(s): Madi, Marwa, Zakaria, Osama, Ichinose, Shizuko, Kasugai, Shohei

Abstract: The aim of this study was to compare the effect of ligature-induced periimplantitis on dental implants with and without hydroxyapatite (HA) coat. Thirty-two dental implants (3.3 mm wide, 13 mm long) with 4 surface treatments (8 implant/group) (M: machined, SA: sandblasted acid etched, S: sputter HA coat and P: plasma-sprayed HA coat) were inserted into canine mandibles. After 12 weeks, oral hygiene procedures were stopped and silk ligatures were placed around the implant abutments to allow plaque accumulation for the following 16 weeks. Implants with the surrounding tissues were retrieved and prepared for histological examination. Bone-to-implant contact (BIC) and implant surfaces were examined using scanning electron microscopy and energy dispersive x-ray spectroscopy. Histological observation revealed marginal bone loss and large inflammatory cell infiltrates in the periimplant soft tissue. Sputter HA implants showed the largest BIC (98.1%) and machined implant showed the smallest values (70.4%). After 28 weeks, thin sputter HA coat was almost completely dissolved, whereas plasma-sprayed HA coat showed complete thickness preservation. Thin sputter HA-coated implants showed more bone implant contact and less marginal bone loss than thick HA-coated implants under periimplantitis condition.

Title: Research of StemBios Cell Therapy on Dental Implants Containing Nanostructured Surfaces: Biomechanical Behaviors, Microstructural Characteristics, and Clinical Trial.

Citation: Implant dentistry, Feb 2016, vol. 25, no. 1, p. 63-73,

Author(s): Ou, Keng-Liang, Weng, Chao-Chia, Wu, Chi-Chang, Lin, Yun-Ho, Chiang, Hsi-Jen

Abstract: The aim of the present study was to examine the osseointegration in low-density bone tissue for SLAffinity-treated implants with StemBios (SB) cell therapy. The morphologies of SLAffinity-treated surfaces were characterized using scanning electron microscopy. In the animal model, implants were installed in the mandibular canine-premolar area of 12 miniature pigs. Each pig received 3 implants of machine, sand blasted, large grit, and acid etched, and SLAffinity-treated implants. In the clinical trial, 10 patients received 1 SLAffinity-treated implant in the maxilla in the posterior area and 1 patient with low bone tissue density received 2 SLAffinity-treated implants with SB cell therapy. Resonance frequency analysis and computed tomography were assessed monthly over the first 3 months after implant placement. The results demonstrated that surface treatment significantly affected early osseointegration in patients who received SB cell therapy. SB cell therapy transferred the stress caused by the implant more uniformly, and the stress decreased with healing time. SLAffinity-treated implants also proved clinically successful after the 3 months. The SLAffinity treatments enhanced osseointegration significantly, especially at early stages of bone tissue healing with SB cell therapy.

Title: Effect of Microthread Design on Marginal Bone Level Around Dental Implants Placed in Fresh Extraction Sockets.

Citation: Implant dentistry, Feb 2016, vol. 25, no. 1, p. 90-96,

Author(s): Khorsand, Afshin, Rasouli-Ghahroudi, Amir Alireza, Naddafpour,
Abstract: This study was designed to compare radiographically the effect of microthread on the coronal portion of the fixture on marginal bone level (MBL) around immediately placed dental implants in human subjects. Forty-one roughened surface screw type Dentium oral implants (Dentium) were inserted in fresh extraction sockets of the anterior segment of maxilla of 30 patients. The implants were selected randomly using either microthread design on coronal portion of the fixture (Implantium) (test group) or without microthread thread design (Superline) (control group). MBL was measured using digital subtraction radiography technique after 3, 6, and 12 months. At month 3, the microthread groups have been associated with more marginal bone loss than the control group (P = 0.04). At months 6 and 12, both groups had comparable bone levels (P = 0.21). The microthread design of the implant collar could not have a positive effect in maintaining the MBL around implants placed in fresh extraction socket in anterior maxilla.

Title: Potential Bone to Implant Contact Area of Short Versus Standard Implants: An In Vitro Micro-Computed Tomography Analysis.

Citation: Implant dentistry, Feb 2016, vol. 25, no. 1, p. 97-102,

Author(s): Quaranta, Alessandro, D'Isidoro, Orlando, Bambini, Fabrizio, Putignano, Angelo

Abstract: To compare the available potential bone-implant contact (PBIC) area of standard and short dental implants by micro-computed tomography (μCT) assessment. Three short implants with different diameters (4.5 × 6 mm, 4.1 × 7 mm, and 4.1 × 6 mm) and 2 standard implants (3.5 × 10 mm and 3.3 × 9 mm) with diverse design and surface features were scanned with μCT. Cross-sectional images were obtained. Image data were manually processed to find the plane that corresponds to the most coronal contact point between the crestal bone and implant. The available PBIC was calculated for each sample. Later on, the cross-sectional slices were processed by a 3-dimensional (3D) software, and 3D images of each sample were used for descriptive analysis and display the microtopography and macrotopography. The wide-diameter short implant (4.5 × 6 mm) showed the higher PBIC (210.89 mm) value followed by the standard (178.07 mm and 185.37 mm) and short implants (130.70 mm and 110.70 mm). Wide-diameter short implants show a surface area comparable with standard implants. Micro-CT analysis is a promising technique to evaluate surface area in dental implants with different macrodesign, microdesign, and surface features.

Title: Risk Factors Associated With Implant Marginal Bone Loss: A Retrospective 6-Year Follow-Up Study.

Citation: Implant dentistry, Feb 2016, vol. 25, no. 1, p. 122-127,

Author(s): Ozgur, Gozde Ozyanat, Kazancioglu, Hakki Oguz, Demirtas, Nihat, Deger, Sabire

Abstract: To analyze the presented evidence behind suggested reasons for long-term marginal bone loss (MBL) around 600 endosseous titanium dental implants according to the radiological findings up to 60 months. The data of 151 patients are received from the
prosthodontic department of a university clinic and analyzed for the effect of implant brand, location, implant diameter and length, implant occlusal table width, cantilever, and smoking on MBL in a 6-year period. MBL is significantly higher in Zimmer SwissPlus implant system. The bone loss in posterior region was higher than anterior region for maxilla. There was no significant difference in mandible. Kruskal-Wallis test showed that MBL was significantly higher when the crown/implant (C/I) ratio was 1.5/2 (P < 0.05). Occlusal table width/implant diameter (OT/I) ratio was analyzed and it showed that MBL was significantly higher when the ratio was 2.5 to 2.99 and higher than 3. There were no significant associations between smoking and nonsmoking groups. Mann-Whitney U test revealed that cantilever does not affect MBL. The marginal bone loss is affected by location of the implants (higher in the maxillary posterior region). In addition, excessive C/I and OT/I ratios increase marginal bone loss.

**Title:** Fixed Implant Supported Rehabilitation of Partially Edentulous Posterior Maxilla in a Patient With Systemic Scleroderma: A Case Report.

**Citation:** Implant dentistry, Feb 2016, vol. 25, no. 1, p. 155-159

**Author(s):** Baptist, Benjamin A

**Abstract:** Systemic Scleroderma (SSc) is an autoimmune disease that affects connective tissue, resulting in hardening skin, reduced vascular perfusion, gingival fibrosis, enlarged periodontal ligament, xerostomia, and trigeminal neuralgia. Secondary effects, including reduced oral opening and reduced manual dexterity may exacerbate the primary effects. Severe bone loss and premature tooth loss are common eventualities of SSc. Removable prosthetics can be a tedious option for these patients as the progression of the disease often leads to the impossibility of obtaining minimal standards of care, including stability, retention, and hygienic maintainability. Implant treatment of patients with Systemic Scleroderma is poorly documented, and common medications used to treat SSc have been considered relative contraindications to the prescription of dental implant therapy. This report describes 1 case after 2 years in function, where dental implants were successfully utilized to offer definitive fixed rehabilitation to a patient with SSc.

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**Title:** FDI policy statement on dental implants: Adopted by the FDI General Assembly: 24 September 2015, Bangkok, Thailand.

**Citation:** International dental journal, Feb 2016, vol. 66, no. 1, p. 5-6,

**Author(s):** FDI World Dental Federation

**Title:** Success of dental implants in smokers and non-smokers: a systematic review and meta-analysis.

**Citation:** International journal of oral and maxillofacial surgery, Feb 2016, vol. 45, no. 2, p. 205-215,

**Author(s):** Moraschini, V, Barboza, E dS Porto
**Abstract:** The purpose of this review was to test the null hypothesis of no difference in marginal bone loss and implant failure rates between smokers and non-smokers with respect to the follow-up period. An extensive electronic search was performed in PubMed, Web of Science, and the Cochrane Central Register of Controlled Trials to identify relevant articles published up to February 2015. The eligibility criteria included randomized and non-randomized clinical studies. After an exhaustive selection process, 15 articles were included. The meta-analysis was expressed in terms of the odds ratio (OR) or standardized mean difference (SMD) with a confidence interval (CI) of 95%. There was a statistically significant difference in marginal bone loss favouring the non-smoking group (SMD 0.49, 95% CI 0.07-0.90; P=0.02). An independent analysis revealed an increase in marginal bone loss in the maxilla of smokers, compared to the mandible (SMD 0.40, 95% CI 0.24-0.55; P<0.00001). A statistically significant difference in implant failure in favour of the non-smoking group was also observed (OR 1.96, 95% CI 1.68-2.30; P<0.00001). However, the subgroup analysis for follow-up time revealed no significant increase in implant failure proportional to the increase in follow-up time (P=0.26).

**Title:** Can we predict the insertion torque using the bone density around the implant?

**Citation:** International journal of oral and maxillofacial surgery, Feb 2016, vol. 45, no. 2, p. 221-225,

**Author(s):** Wada, M, Suganami, T, Sogo, M, Maeda, Y

**Abstract:** The purpose of this study was to examine the correlation between initial stability and bone density in patients undergoing implant treatment. Twenty-five screw-type dental implants were inserted in 12 patients. All patients underwent multi-detector computed tomography (CT) examination prior to implant insertion. The implant sockets were prepared according to the drilling protocol, and peak insertion torque values were measured. CT values around the implants were measured using preoperatively scanned CT data, which were combined with actual implant positions. Spearman's rank correlation coefficient was used to investigate the correlation between insertion torque values and CT values (in Hounsfield units, HU). Twenty-three implants (8 or 10mm in length) were inserted in the mandibular molar region and two (10mm length) in the maxillary molar region. The mean CT value of the 8-mm implants was 508.6±187.0HU and mean insertion torque was 27.2±12.1N·cm; for the 10-mm implants, these values were 579.6±224.3HU and 28.1±14.6N·cm, respectively. Statistical analysis revealed a strong positive correlation between the insertion torque and mean CT values (r=0.699, 8mm; r=0.771, 10mm). The results revealed that bone density around the implant is a useful index. This study indicates that preoperative CT may enable the prediction of initial implant stability.

**Title:** Immediate implant placement in fresh sockets versus implant placement in healed bone for full-arch fixed prostheses with conventional loading.

**Citation:** International journal of oral and maxillofacial surgery, Feb 2016, vol. 45, no. 2, p. 226-231,
**Author(s):** Altintas, N Y, Taskesen, F, Bagis, B, Baltacioglu, E, Cezairli, B, Senel, F C

**Abstract:** This retrospective study assessed the success of immediate and non-immediate implants installed in patients undergoing planned extraction of all remaining teeth and rehabilitation with implant-supported full fixed prostheses. Patients in need of dental implants for full fixed prostheses to replace teeth extracted in the maxilla and mandible were included in this study. Dental implants were installed in the same surgical procedure, immediately at the extraction site, or in healed bone. Implant success, complications, and failures were recorded during follow-up. Forty-one patients with 512 implants were included in the study. Healing progressed uneventfully for 501 installed implants, but nine implants were lost in the non-immediate group and two were lost in the immediate group, during a mean follow-up of 44.9 months. All failures in both groups were observed in the maxilla. The success rate was the same in both groups, at 97.8%. This retrospective analysis showed that with thorough patient evaluation, the extraction of all residual teeth and implant installation in a single surgical procedure is a safe and predictable treatment modality for the successful rehabilitation of the edentulous patient with a fixed prosthesis.

**Title:** Surface immobilization and bioactivity of TGF-β1 inhibitor peptides for bone implant applications.

**Citation:** Journal of biomedical materials research. Part B, Applied biomaterials, Feb 2016, vol. 104, no. 2, p. 385-394

**Author(s):** Sevilla, Pablo, Vining, Kyle V, Dotor, Javier, Rodriguez, Daniel, Gil, F Javier,

**Abstract:** TGF-β1 is the most related cytokine with the production of fibrotic tissue. It plays an important role on the production of collagen by fibroblasts and other types of cells. The inhibition of this cytokine reduces fibrosis in various types of tissue. Biofunctionalization of dental and orthopedic implants with biomolecules enables modification of the physical, chemical and biochemical properties of their surfaces to improve its biological and clinical performance. Our objective was to develop a reliable method to immobilize oligopeptides on Ti surfaces to obtain a surface with TGF-β1 inhibitory activity that will potentially minimize fibrotic encapsulation of implants during the process of osseointegration. We covalently immobilized TGF-β1 inhibitor P17-peptides on Ti surfaces and assessed by characterizing each step of the process that we successfully biofunctionalized the implant surfaces. High amounts of peptides were anchored and homogeneously distributed on the surfaces with mechanical and thermochemical stability after in vitro simulated challenges. Notably, the immobilized peptides retained their TGF-β1 inhibitory activity in vitro. Thus, these biofunctional coatings are potential candidates for inducing a fast and reliable osseointegration in vivo.

**Title:** Effect of sustained release of rhBMP-2 from dried and wet hyaluronic acid hydrogel carriers compared with direct dip coating of rhBMP-2 on peri-implant osteogenesis of dental implants in canine mandibles.

**Citation:** Journal of cranio-maxillo-facial surgery : official publication of the European Association for Cranio-Maxillo-Facial Surgery, Feb 2016, vol. 44, no. 2, p. 116-125
Author(s): Pan, Hui, Han, Jeong Joon, Park, Yong-Doo, Cho, Tae Hyung, Hwang, Soon Jung

Abstract: Hyaluronic acid (HA) hydrogel has been used as a carrier of recombinant human bone morphogenetic protein (rhBMP)-2 for sustained delivery. To enhance peri-implant osteogenesis, a dried coating of rhBMP-2 HA hydrogel (BMP-HAH) on dental implants was designed; this approach provides the advantage of omitting in situ preparation of wet HA hydrogel. Sustained release of rhBMP-2 was more efficient for dried hydrogel over wet hydrogel. For both types, the released rhBMP-2 consistently led to enhanced alkaline phosphatase activity and osterix expression in human mesenchymal stromal cells. Histomorphometric analysis 4 weeks after placement of a dental implant in canine mandibles showed that the dried coating of BMP-HAH (10 μg/ml, n = 6) resulted in a significantly greater bone area (BA) than the wet BMP-HAH (10 μg/ml, n = 6) (p = 0.006) and implants without any coating (n = 6) (p = 0.022), while simple dip coating with rhBMP-2 (10 μg/ml, n = 6) resulted in significantly greater BA than the other three groups (p < 0.0005). Bone-to-implant contact (BIC) was significantly different only between the dried and wet coating of BMP-HAH (p = 0.014). Our results suggest that a simple dip coating of rhBMP-2 is more effective for increased peri-implant osteogenesis compared to a coating of BMP-HAH with sustained release.

Title: Clinical Practice Guidelines for Recall and Maintenance of Patients with Tooth-Borne and Implant-Borne Dental Restorations.

Citation: Journal of dental hygiene : JDH / American Dental Hygienists' Association, Feb 2016, vol. 90, no. 1, p. 60-69,

Author(s): Bidra, Avinash S, Daubert, Diane M, Garcia, Lily T, Kosinski, Timothy F,

Abstract: To provide guidelines for patient recall regimen, professional maintenance regimen, and at-home maintenance regimen for patients with tooth- and implant-borne removable and fixed restorations. The American College of Prosthodontists (ACP) convened a scientific panel of experts appointed by the ACP, American Dental Association (ADA), Academy of General Dentistry (AGD), and American Dental Hygienists Association (ADHA) who critically evaluated and debated recently published findings from 2 systematic reviews on this topic. The major outcomes and consequences considered during formulation of the clinical practice guidelines (CPGs) were risk for failure of tooth- and implant-borne restorations. The panel conducted a round table discussion of the proposed guidelines, which were debated in detail. Feedback was used to supplement and refine the proposed guidelines, and consensus was attained. A set of CPGs was developed for tooth-borne restorations and implant-borne restorations. Each CPG comprised of 1) patient recall; 2) professional maintenance, and 3) at-home maintenance. For tooth-borne restorations, the professional maintenance and at-home maintenance CPGs were subdivided for removable and fixed restorations. For implant-borne restorations, the professional maintenance CPGs were subdivided for removable and fixed restorations and further divided into biological maintenance and mechanical maintenance for each type of restoration. The at-home maintenance CPGs were subdivided for removable and fixed restorations. The clinical practice guidelines presented in this document were initially developed using the 2
systematic reviews. Additional guidelines were developed using expert opinion and consensus, which included discussion of the best clinical practices, clinical feasibility and risk-benefit ratio to the patient. To the authors' knowledge, these are the first CPGs addressing patient recall regimen, professional maintenance regimen, and at-home maintenance regimen for patients with tooth-borne and implant-borne restorations. This document serves as a baseline with the expectation of future modifications when additional evidence becomes available.

Title: Does crown/implant ratio influence the survival and marginal bone level of short single implants in the mandibular molar? A preliminary investigation consisting of 12 patients.

Citation: Journal of oral rehabilitation, Feb 2016, vol. 43, no. 2, p. 127-135,

Author(s): Ghariani, L, Segaan, L, Rayyan, M M, Galli, S, Jimbo, R, Ibrahim, A

Abstract: Crown/implant (C/I) ratio has been proven to not affect the survival of the implants; however, it is also a fact that no evidence exists with regard to the use of single short implants in the mandibular molar. The aim of this study was to determine whether the crown/implant ratios of single implant-supported fixed restorations on implants of 6-8 mm in the mandibular molar have an impact on the implant survival and marginal bone maintenance. Twelve short dental implants (6-8 mm) were installed and restored with single crowns, loaded after 3 months of healing. The restorations were divided according to crown-to-implant ratio into two groups: Group 1: C/I < 2.0 and Group 2: C/I ≥ 2.0. Alveolar bone loss was measured using CBCT scan, taken at the implant placement and after 12 months follow-up from loading. Reduced implant/crown ratio shown no statistic significant differences on implant survival and the alveolar bone level compared with recommended implant/crown ratio. Within the limitation of this study, it can be concluded that reduced C/I ratio could be used as a substitute for recommended C/I ratio in severely mandibular atrophic residual alveolar ridges.

Title: Implant Impression Techniques for the Edentulous Jaw: A Summary of Three Studies.

Citation: Journal of prosthodontics : official journal of the American College of Prosthodontists, Feb 2016, vol. 25, no. 2, p. 146-150,

Author(s): Stimmelmayr, Michael, Beuer, Florian, Edelhoff, Daniel, Güth, Jan-Frederik

Abstract: Precise implant-supported restorations require accurate impressions. Transfer, pick-up, and splinted pick-up are commonly used techniques. Several in vitro studies have compared these impression techniques; however, all studies used mechanical evaluation methods. The purpose of this study was to compare the discrepancies of these impression techniques digitally in vitro and in vivo. Four dental implants were inserted in ten polymer mandibular models bilaterally in the regions of the first molars and canines. Three different impressions were made of each model and the models (original and stone casts) were scanned and digitized. Clinically, four implants were inserted in ten edentulous jaws; transfer and splinted pick-up impressions were made. With inspection software,
discrepancies between the different impressions were calculated. The mean discrepancies in the in vitro study of the original polymer model to stone casts were 124 ± 34 μm for the transfer type, 116 ± 46 μm for the pick-up type, and 80 ± 25 μm for the splinted pick-up type, resulting in a mean discrepancy between the transfer and splinted pick-up type of 44 μm (124 - 80 μm). Clinically, the mean discrepancy between these two impression techniques was 280 μm. The differing results between the transfer and splinted pick-up techniques of in vitro and in vivo data showed the need for clinical data; however, splinted pick-up impressions seemed to produce the most precise results.

Title: Low-level laser therapy affects osseointegration in titanium implants: resonance frequency, removal torque, and histomorphometric analysis in rabbits.

Citation: Journal of the Korean Association of Oral and Maxillofacial Surgeons, Feb 2016, vol. 42, no. 1, p. 2-8,

Author(s): Kim, Jong-Ryoul, Kim, Sung-Hee, Kim, In-Ryoung, Park, Bong-Soo, Kim, Yong-Deok

Abstract: The purpose of this study was to investigate the effects of low-level laser therapy (LLLT) with a diode gallium-aluminum-arsenide (Ga-Al-As) low-level laser device on the healing and attachment of titanium implants in bone. Thirteen New Zealand white male rabbits weighing 3.0±0.5 kg were used for this study. Dental titanium implants (3.75 mm in diameter and 8.5 mm in length, US II RBM plus fixture; Osstem, Seoul, Korea) were implanted into both femurs of each rabbit. The rabbits were randomly divided into a LLLT group and a control group. The LLLT was initiated immediately after surgery and then repeated daily for 7 consecutive days in the LLLT group. Six weeks and 12 weeks after implantation, we evaluated and compared the osseointegration of the LLLT group and control group, using histomorphometric analysis, removal torque testing, and resonance frequency analysis (RFA). The results were statistically significant when the level of probability was 0.05 or less based on a non-parametric Mann-Whitney U-test. The implant survival rate was about 96%. Histologically and histomorphometrically, we observed that the titanium implants were more strongly attached in LLLT group than in control group. However, there was no significant difference between the LLLT group and control group in removal torque or RFA. Histologically, LLLT might promote cell-level osseointegration of titanium implants, but there was no statistically significant effects.

Title: Pressure behavior of different PEEK materials for dental implants.

Citation: Journal of the mechanical behavior of biomedical materials, Feb 2016, vol. 54, p. 295-304,

Author(s): Schwitalla, Andreas Dominik, Spintig, Tobias, Kallage, Ilona, Müller, Wolf-Dieter

Abstract: Due to its mechanical properties, the biocompatible high-performance material PEEK (polycarbonate ether ketone) and PEEK-based compounds may represent viable alternatives to titanium in the field of dental implantology. Therefore we performed static pressure tests with 11 PEEK materials (two unfilled grades, two grades filled with titanium-dioxide-powder, two grades filled with barium-sulfate-powder, two grades reinforced with short carbon
fibers, one grade reinforced with glass fibers and two grades reinforced with continuous carbon fibers) in the form of cylindrical specimens with a diameter of 4, 5 and 6mm. The specimens had a height to diameter ratio of 2:1 and were therefore 8, 10 and 12mm high. The parameters elastic modulus, elastic limit and pressure strength were evaluated. The elastic moduli ranged between 2.65±0.03GPa for specimens of a titanium-dioxide-filled grade and 106.71±14.83GPa for specimens reinforced with continuous carbon fibers. The elastic limits ranged between 808.1±42.44N for specimens of a barium-sulfate-filled grade and 7256.4±519.86N for specimens reinforced with continuous carbon fibers. The lowest pressure strength of 122.77MPa was observed for specimens of an unfilled grade, whereas the highest pressure strength of 712.67±66.02MPa could be evaluated for specimens containing continuous carbon fibers. Regarding the maximum bite force of a first molar, all tested materials seem to be suitable for the use as dental implants.

Title: Lack of clinical evidence on low-level laser therapy (LLLT) on dental titanium implant: a systematic review.

Citation: Lasers in medical science, Feb 2016, vol. 31, no. 2, p. 383-392,

Author(s): Prados-Frutos, J C, Rodríguez-Molinero, J, Prados-Privado, M, Torres, J H, Rojo, R

Abstract: Low-level laser therapy (LLLT) has proved to have biostimulating effects on tissues over which they are applied, therefore accelerating the healing process. Most studies in implantology were focused on a reduction of the duration of osseointegration. There exist few articles analyzing the potential effects of these therapies on the osseointegration of titanium dental implants. The aim of this study was to assess the effect of LLLT on the interaction between the bone and the titanium dental implant and the methodological quality of the studies. We conducted an electronic search in PubMed, ISI Web, and Cochrane Library. From 37 references obtained, only 14 articles met the inclusion criteria. The analysis of the studies shows that most of the experiments were performed in animals, which have a high risk of bias from the methodological point of view. Only two studies were conducted in human bone under different conditions. Several protocols for the use of low-power laser and different types of laser for all studies analyzed were used. Although animal studies have shown a positive effect on osseointegration of titanium implants, it can be concluded that it is necessary to improve and define a unique protocol to offer a more conclusive result by meta-analysis.


Citation: Photomedicine and laser surgery, Feb 2016, vol. 34, no. 2, p. 61-67,

Author(s): Hajji, Mohammad, Franzen, Rene, Grümer, Stefan, Modabber, Ali, Nasher, Riman,

Abstract: The purpose of this study was to compare the conventional trephine bur and the Erbium, chromium: yttrium-scandium-gallium-garnet (Er,Cr:YSGG) laser in removing implants in terms of the volume of removed bone, duration of the procedure, and morphological changes on the bone surface. Three human mandibles were utilized, and four implants were
inserted in each mandible using a drilling handpiece and burs. The implants were divided into two groups (n = 6) in which two implants from each mandible were removed using a trephine bur running at 1200 rounds per minute (rpm) with water irrigation. The remaining implants (n = 6) were removed with Er,Cr:YSGG laser (power 6 W, frequency 20 Hz, pulse duration 50 μs, water 60, air 30). The volume of bone loss was calculated by filling the holes with mercury and measuring its volume. The preparation time was measured with a digital stopwatch and the postoperative bone surfaces were examined under a scanning electron microscope (SEM). The laser group exhibited a smaller amount of bone loss than the trephine bur group, whereas the latter required a shorter time of preparation. SEM revealed empty trabecular spaces with no signs of carbonization and well-defined edges in the laser group, whereas the trephine group displayed a surface covered with a smear layer and microcracks. The Er,Cr:YSGG laser provides superior results over the trephine bur in terms of bone preservation, thermal damage, and cutting efficiency.

Title: Long-Term Computed Tomographic Evaluation of Alveolar Bone Formation in Patients with Unilateral Cleft Lip and Palate after Early Secondary Gingivoalveoloplasty.

Citation: Plastic and reconstructive surgery, Feb 2016, vol. 137, no. 2, p. 365e,

Author(s): Meazzini, Maria Costanza, Corno, Martina, Novelli, Giorgio, Autelitano, Luca,

Abstract: The goal of this study was to evaluate with a three-dimensional method the long-term quality of alveolar ossification in unilateral cleft lip and palate patients who underwent early secondary gingivoalveoloplasty according to the Milan surgical protocol. The sample consisted of 63 computed tomographic scans of unilateral cleft lip and palate patients in permanent dentition. The average age at the time of assessment was 15.7 years. Alveolar thickness, nasoalveolar height, nasal floor ossification, and hard palate morphology were evaluated using dental, axial, and coronal cuts on computed tomographic scans and three-dimensional models. All measurements were normalized and ratios of the affected side versus the nonaffected side were provided. Volume measurements and ratios of each hemimaxilla were added. The presence or absence of the permanent lateral incisor on the cleft side was also recorded. Alveolar thickness and height were ideal or good, respectively, in 89.5 and 91.4 percent of the sample. Insufficient ossification (<25 percent) was found in three patients (5.2 percent), and only one of them (1.7 percent) presented no bone bridging. A statistically significant association was detected between the degree of alveolar ossification, the type of nasal floor ossification, and volume ratio. Early secondary gingivoalveoloplasty seemed to allow an adequate ossification of both the alveolar and nasal region. Three-dimensional evaluation of the alveolar cleft ossification provided further information on alveolar bridging and allowed evaluation of the bone availability for implant placement. Therapeutic, IV.

Title: Surface Topographical Changes of a Failing Acid-Etched Long-Term in Function Retrieved Dental Implant.

Citation: The Journal of oral implantology, Feb 2016, vol. 42, no. 1, p. 12-16, 1548-1336

Author(s): Monje, Alberto, González-García, Raúl, Fernández-Calderón, María Coronada,
Abstract: The aim of the present study was to report the main topographical and chemical changes of a failing 18-year in function retrieved acid-etching implant in the micro- and nanoscales. A partially edentulous 45 year old rehabilitated with a dental implant at 18 years of age exhibited mobility. After careful examination, a 3.25 × 13-mm press-fit dental implant was retrieved. Scanning electron microscope (SEM) analysis was carried out to study topographical changes of the retrieved implant compared with an unused implant with similar topographical characteristics. Moreover, X-ray photoelectron spectroscopy (XPS) analysis was used to study the surface composition of the retrieved failing implant. Clear changes related to the dual dioxide layer are present as visible in ≥×500 magnification. In addition, it was found that, for the retrieved implant, the surface composition consisted mainly of Ti2p, O1s, C1s, and Al2p. Also, a meaningful decrease of N and C was noticed, whereas the peaks of Ti2p, Al2p, and O1s increased when analyzing deeper (up to ×2000s) in the sample. It was shown that the superficial surface of a retrieved press-fit dual acid-etched implant 18 years after placement is impaired. However, the causes and consequences for these changes cannot be determined.

Title: Immediate and Early Loading of Hydrothermally Treated, Hydroxyapatite-Coated Dental Implants: 2-Year Results from a Prospective Clinical Study.

Citation: The Journal of oral implantology, Feb 2016, vol. 42, no. 1, p. 17-25, 1548-1336

Author(s): Simmons, David E, Palaiologou, Archontia, Teitelbaum, Austin G, Billiot,
Title: Stress Distribution on Short Implants at Maxillary Posterior Alveolar Bone Model With Different Bone-to-Implant Contact Ratio: Finite Element Analysis.

Citation: The Journal of oral implantology, Feb 2016, vol. 42, no. 1, p. 26-33,

Author(s): Yazicioglu, Duygu, Bayram, Burak, Oguz, Yener, Cinar, Duygu, Uckan, Sina

Abstract: The aim of this study was to evaluate the stress distribution of the short dental implants and bone-to-implant contact ratios in the posterior maxilla using 3-dimensional (3D) finite element models. Two different 3D maxillary posterior bone segments were modeled. Group 1 was composed of a bone segment consisting of cortical bone and type IV cancellous bone with 100% bone-to-implant contact. Group 2 was composed of a bone segment consisting of cortical bone and type IV cancellous bone including spherical bone design and homogenous tubular hollow spaced structures with 30% spherical porosities and 70% bone-to-implant contact ratio. Four-millimeter-diameter and 5-mm-height dental implants were assumed to be osseointegrated and placed at the center of the segments. Lateral occlusal bite force (300 N) was applied at a 25° inclination to the implants long axis. The maximum von Mises stresses in cortical and cancellous bones and implant-abutment complex were calculated. The von Mises stress values on the implants and the cancellous bone around the implants of the 70% bone-to-implant contact group were almost 3 times higher compared with the values of the 100% bone-to-implant contact group. For clinical reality, use of the 70% model for finite element analysis simulation of the posterior maxilla region better represents real alveolar bone and the increased stress and strain distributions evaluated on the cortical and cancellous bone around the dental implants.

Title: In Vitro Evaluation of Titanium Exfoliation During Simulated Surgical Insertion of Dental Implants.

Citation: The Journal of oral implantology, Feb 2016, vol. 42, no. 1, p. 34-40,

Author(s): Sridhar, Sathyanarayanan, Wilson, Thomas G, Valderrama, Pilar,

Abstract: Dissolution of titanium wear particles in the oral environment, and their accumulation in the surrounding tissues have been associated with failure of dental implants (DI). The goal of this study is to investigate the effect of mechanical forces involved in surgical insertion of DI on surface wear and metal particle generation. It was hypothesized that mechanical factors associated with implant placement can lead to the generation of titanium particles in the oral environment. The testing methodology for surface evaluation employed simulated surgical insertion, followed by removal of DI in different densities of simulated bone material. Torsional forces were monitored for the insertion and removal of DI. The surface of the simulated bone materials was inspected with optical microscopy to detect traces of metallic particles that may have been generated during the procedure. Further characterization of the composition of powders collected from osteotomy cavities was conducted with powder X-ray diffraction. The results showed that the different densities of simulated bone material affected the torsional forces associated with implant insertion. However, the mechanical factors involved in the implant
Title: Retrospective Analysis of Implant Overdenture Treatment in the Advanced Prosthodontic Clinic at the University of Illinois at Chicago.

Citation: The Journal of oral implantology, Feb 2016, vol. 42, no. 1, p. 46-53,

Author(s): Marinis, Aristotelis, Afshari, Fatemeh S, Yuan, Judy Chia-Chun, Lee

Abstract: The aim of the present retrospective study was to evaluate the clinical outcomes of implant-supported overdenture treatment provided by prosthodontic specialty residents. Twenty-three patients with 25 implant-supported overdentures (IODs) participated in the study. Seventy-four implants were placed by periodontic, prosthodontics, or oral and maxillofacial surgery students. All prostheses were fabricated in the advanced prosthodontics clinic at University of Illinois at Chicago. The condition of the peri-implant soft tissue, implants, and prostheses were evaluated. Complications and any maintenance were documented. Patients completed an oral health impact profile-14 and semantic differential scale questionnaires. Statistical analyses were performed using SPSS statistical software. Twenty mandibular and 5 maxillary IODs were evaluated. Ninety-seven percent of the attachments were locators (Zest Anchors) and 3% ball attachments. None of the implants had lost osseointegration, but 14 implants (19%) had developed marginal bone loss in one-third of the implant length or more. Fourteen (19%) implants had developed dehiscence, which ranged from 1 to 4 mm. A variation in the width of the keratinized tissue, gingival, plaque, and calculus index was observed. There was a statistically significant relationship between the presence of plaque and the bleeding on probing on the buccal aspect of implants (P = .012). The incidence of dehiscence was significantly higher on the midfacial when the keratinized tissue was less than 2 mm (P < .0001). The majority of the complications were prosthetic in nature, such as broken denture teeth (74%) and worn or loose matrices (35%). Debris was observed in 19% of the locator abutments, and 36% of the overdentures were not stable in application of anterior force. Patients were compliant with oral hygiene protocols and their chewing ability was high (mean = 8.0). The overall experience was pleasant (mean = 7.5); the treatment provided good esthetics (mean = 8.3) and great satisfaction (mean = 8.5). From an educational and clinical perspective, IOD therapy has been documented to be a predictable and successful treatment option. Patients should be informed of the required maintenance and the possible complications related to IOD therapy.

Title: Immunophenotype of Dental Implant-Associated Peripheral Giant Cell Reparative Granuloma in a Representative Case Report.

Citation: The Journal of oral implantology, Feb 2016, vol. 42, no. 1, p. 55-60,

Author(s): Galindo-Moreno, Pablo, Hernández-Cortés, Pedro, Ríos, Rosa, Sánchez-Fernández, Elena, Cámara, Miguel, O'Valle, Francisco
Abstract: We report the case of a 74-year-old white male patient who had worn an overdenture for the previous 6 years, retained by 4 screwed implants and a bar, who presented with an exophytic multilobed lesion of 2.5 × 2.0 cm on the anterior aspect of 1 implant neck, which was surrounded by pink-reddish tissue. All of the soft tissue around the implant was removed until the periosteum was reached. Histologic examination of the lamina propria revealed a cellular proliferation with imprecise boundaries, dense stromal component composed of spindle- to round-shaped mononucleated cells (fibroblasts and monocytes/macrophages), abundant multinucleated giant cells surrounding microscopic hemorrhagic foci, and deposits of hemosiderin; the diagnosis was peripheral giant-cell reparative granuloma (PGCG). Giant cells share the immunohistochemical expression of monocyte/macrophage markers (CD68, calprotectin [Mc387]) and osteoclastic cell markers (tartrate-resistant acid phosphatase, cathepsin K, and microphthalmia-associated transcription factor). After 6 months of follow-up, no bone resorption or recurrence of implant loss was observed. There have been only 12 case reports on dental implant-associated PGCG. Research results to date indicate that there may be little difference in immunophenotype among the giant cells of PGCG, central giant cell reparative granuloma, and peri-implant osteolysis. In conclusion, the immunohistochemical study confirms an osteoclast like giant cells phenotype differentiation in PGCG.

Title: Minimally Invasive Surgical Approaches for Esthetic Implant Dentistry: A Case Report.

Citation: The Journal of oral implantology, Feb 2016, vol. 42, no. 1, p. 93-97,

Author(s): Hayashi, Joichiro, Shin, Kitetsu, Takei, Henry H

Title: Accidental Displacement of the Dental Implant into the Medullary Space in the Posterior Mandible: Case Reports.

Citation: The Journal of oral implantology, Feb 2016, vol. 42, no. 1, p. 110-113,

Author(s): Oh, Ji-Su, Kim, Su-Gwan, You, Jae-Seek

Title: Prosthetic rehabilitation with an implant-supported fixed prosthesis using computer-aided design and computer-aided manufacturing dental technology for a patient with a mandibulectomy: A clinical report.

Citation: The Journal of prosthetic dentistry, Feb 2016, vol. 115, no. 2, p. 133-136,

Author(s): Yoon, Hyung-In, Han, Jung-Suk

Abstract: The fabrication of dental prostheses with computer-aided design and computer-aided manufacturing shows acceptable marginal fits and favorable treatment outcomes. This clinical report describes the management of a patient who had undergone a mandibulectomy and received an implant-supported fixed prosthesis by using additive manufacturing for the framework and subtractive manufacturing for the monolithic zirconia restorations.
Title: Intraoral digital impression for fabricating a replica of an implant-supported interim prosthesis.

Citation: The Journal of prosthetic dentistry, Feb 2016, vol. 115, no. 2, p. 145-149,

Author(s): Lee, Ju-Hyoung

Abstract: Even though a customized scannable impression coping is used, the precise replication of the emergent profile developed by an implant-supported interim prosthesis (ISIP) is difficult. This article describes a method for overcoming the limitations of a customized scannable impression coping. With this technique, a customized scannable impression coping is eliminated, and the information from an ISIP is obtained.

Title: Risk factors associated with early implant failure: A 5-year retrospective clinical study.

Citation: The Journal of prosthetic dentistry, Feb 2016, vol. 115, no. 2, p. 150-155,

Author(s): Olmedo-Gaya, Maris Victoria, Manzano-Moreno, Francisco J, Cañaveral-Cavero,

Abstract: The replacement of lost teeth with dental implants is a widespread treatment whose associated problems are also frequently encountered. Nevertheless, the factors associated with early implant failure have not been well documented. Further analyses of the factors influencing osseointegration establishment are required to maximize the predictability of the procedure and minimize implant failures. The purpose of this retrospective clinical study was to explore the association between possible risk factors and early implant failure. This retrospective clinical study evaluated 142 participants who received 276 external connection BTI implants between 2007 and 2011. Participant variables (age, sex, systemic disease, tobacco use, alcohol consumption, bruxism, and degree of periodontal disease), implant variables (type of edentulism, localization, area, diameter, length, and bone quality), intervention variables (expansion mechanisms, sinus augmentation techniques, bone regeneration, and implant insertion), and postoperative variables (presence of pain/inflammation at 1 week postsurgery) were studied. A multilevel logistic regression model (mixed effects-type model) was used to determine the influence of variables on early implant failure. Early implant failure was significantly associated with the male sex (P=.001), severe periodontal disease (P=.005), short implants (P=.001), expansion technique (P=.002), and postoperative pain/inflammation at 1 week postsurgery (P<.001). Early dental implant failure is more frequent in men and in individuals with severe periodontal disease, short implants, pain/inflammation at 1 week postsurgery, or bone expansion treatment.

Title: Anterior loop of the inferior alveolar nerve: Averages and prevalence based on CT scans.

Citation: The Journal of prosthetic dentistry, Feb 2016, vol. 115, no. 2, p. 156-160,

Author(s): Juan, Del Valle Lovato, Grageda, Edgar, Crespo, Salvador Gómez
**Abstract:** The treatment of edentulous patients by using a complete implant-supported fixed prosthesis with distal extension has been widely studied; success is mainly dependent upon the placement of the distal implants. The location of the inferior alveolar nerve determines implant placement, but the length, prevalence, and symmetry between the left and right side of the anterior loop of the alveolar nerve are unknown. The purpose of this clinical study was to measure the anterior loop of the inferior alveolar nerve, which determines the placement of distal implants, in a group of 55 Mexican participants. The study expected to ascertain the average length, prevalence, and symmetry between left and right side and any sex differences. To differentiate the inferior alveolar nerve path, a new technique was applied using Hounsfield unit (HU) thresholds. The null hypothesis was that no significant differences would be found between the left and right sides or between men and women for the anterior loop of the inferior alveolar nerve. Fifty-five computed tomography (CT) scans were made (Somatom Sensation 16; Siemens Healthcare) and were visualized with InVesalius software. Anterior loop measurements were made on 3-dimensional surfaces. To determine statistical differences between the left and right side and between the sexes, the t test was used. The interclass correlation coefficient test was also applied to verify the reliability of the measurements. Ninety percent of participants showed the anterior loop of the inferior alveolar nerve. The length of the anterior loop ranged between 0 and 6.68 mm, with a mean of 2.19 mm. No significant differences were found between the left and right sides or between men and women. The mean length for the anterior loop in the sample was 2.19 mm. As the anterior loop length shows a high degree of variability, these findings suggest that a CT scan for each patient is recommended in order to visualize a safety zone before placing implants close to the mental foramen.

**Title:** Effect of implant number and distribution on load transfer in implant-supported partial fixed dental prostheses for the anterior maxilla: A photoelastic stress analysis study.

**Citation:** The Journal of prosthetic dentistry, Feb 2016, vol. 115, no. 2, p. 161-169,

**Author(s):** Lee, Jae-In, Lee, Yoon, Kim, Yu-Lee, Cho, Hye-Won

**Abstract:** The 4-, 3- or even 2-implant-supported partial fixed dental prosthesis (PFDP) designs have been used to rehabilitate the anterior edentulous maxilla. The purpose of this in vitro study was to compare the stress distribution in the supporting tissues surrounding implants placed in the anterior maxilla with 5 PFDP designs. A photoelastic model of the human maxilla with an anterior edentulous region was made with photoelastic resin (PL-2; Vishay Micro-Measurements), and 6 straight implants (OsseoSpeed; Astra Tech AB) were placed in the 6 anterior tooth positions. The 5 design concepts based on implant location were as follows: model 6I: 6 implants; model 2C2CI: 4 implants (2 canines and 2 central incisors); model 2C2LI: 4 implants (2 canines and 2 lateral incisors); model 2C1CI: 3 implants (2 canines and 1 central incisor); and model 2C: 2 canines. A load of 127.4 N was applied on the cingulum of 3 teeth at a 30-degree angle to the long axis of the implant. Stresses that developed in the supporting structure were recorded photographically. The 6-implant-supported PFDP exhibited the most even and lowest distribution of stresses in all loading conditions. When the canine was loaded, the 2- or 3-implant-supported PFDP showed higher stresses around the implant at the canine position than did the 4- or 6-implant-supported PFDP. When the central incisor or lateral incisor was loaded, the two 4-implant-
supported PFDPs exhibited similar levels of stresses around the implants and showed lower stresses than did the 2- or 3-implant-supported PFDP. Implant number and distribution influenced stress distribution around the implants in the anterior maxilla. With a decrease in implant number, the stresses around the implants
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