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Editor: John L. Reyher, DDS, Danville, IL, concentrated his career in clinical practice and clinical research in the Department of Veterans Affairs

Current Overview

Kohal R-J, Klaus G, Strub JR. Zirconia-implant-supported all-ceramic crowns withstand long-term load: a pilot investigation. Clin Oral Implants Res 17(5):565-571, 2006.

This study evaluated the biomechanical behavior of 2 types of all-ceramic crowns luted to a zirconia implant. Sixteen porcelain-fused-to-metal (PFM) crowns cemented to 16 titanium implants were used as controls. The 2 test groups included 16 Empress I and 16 Procera crowns cemented to 32 zirconia implants.

The ReImplant unit fabricated the titanium implant and the Celay system was used to fabricate a zirconia implant. PFM crowns were cemented to the implant abutments using zinc phosphate cement; the Empress and Procera crowns were cemented using Panavia 21. Eight samples from each of the groups were then loaded in a chewing simulator and subjected to thermal cycling, representing 5 years of clinical loading.

Seven of the loaded and 7 of the unloaded from each group were subjected to a fracture test using a universal testing machine. One of the loaded and 1 of the unloaded were evaluated for marginal gap size. No fracture of any component was found; however, 3 of the

Zirconia implants

Clinical Practice Point

Clinical viability of zirconia implants with Procera crowns

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Empress crowns demonstrated fracture lines on the lingual of the crown corresponding to the load site.

No statistical significance within groups for the loaded versus unloaded samples was found. When not loaded, the groups did not show any statistically significant difference. After loading, the PFM and Procera demonstrated significantly higher strength values as compared to the Empress I crowns. After the simulated loading, 2 PFM, 6 Empress I, and 2 Procera crowns fractured below 500 N. PFM marginal fit pre-load was 54.3 and after load was 53 microns. The Empress I pre-load was 79.1 and after load was 84.6 microns. The Procera crowns pre-load measured 90.9 and after load 98.7 microns.

Within the limitation of this study, some evidence seems to suggest that a zirconia implant with a Procera crown may be able to withstand a 5-year functional period.

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Implants & bone integration

Clinical Practice Point

Implant bone contact and density enhanced

Grassi S, Piattelli A, Ferrari DS, Figueiredo LC, Feres M, Iezzi G, Shibli JA. Histologic evaluation of human bone integration on machined and sandblasted acid-etched titanium surfaces in type IV bone. J Oral Implantol 33(1):8–12, 2007.

The objective of this article was to evaluate and compare the bone contact and density between machined and sandblasted acid

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etched grade-4 titanium implants surfaces. Five human subjects received conventional implant placement in the posterior maxilla, after which micro-implants (2.5 mm × 6 mm) with the experimental surfaces were placed posterior to the most distal implant.

After 2 months the micro-implants were trephined out and were visually and histologically evaluated. Upon removal 1 machined implant was excluded because of extreme mobility. The sandblasted acid etched implants visually had more adherent bone.

Machined surfaces had a mean bone implant contact of 20.66% ± 14.54% and the sandblasted acid etched surfaces had a mean bone implant contact of 40.08% ± 9.89%. Bone density measurements were 26.33% ± 19.92% for machined and 54.84% ± 22.77% for sandblasted acid etched surfaces. This study suggested a higher bone implant contact and bone density for the sandblasted acid etched surfaces.

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Carrilho MR, Carvalho RM, de Goes MF, di Hipólito V, Geraldeli S, Tay FR, Pashley DH, Tjäderhane L. Chlorhexidine preserves dentin bond in vitro. J Dent Res 86(1):90–94, 2007.

Premature loss of bond strength is one of the main problems that cause failures in adhesive restorations. The degradation of the hybrid layer at the dentin-adhesive interface has been suggested to contribute to loss of bond strength.

Recent studies have suggested that matrix metalloproteinases (MMPs) may be partially responsible for hybrid layer degradation through the deterioration of dentin collagen fibrils. Since chlorhexidine has been shown to inhibit MMPs, it was hypothesized that MMP inhibition by chlorhexidine application prior to formation of the hybrid layer would decelerate the decrease of bond strength frequently seen in the microtensile model after aging. It was also hypothesized that external MMP inhibition would further improve the preservation of the hybrid layer.

Seven unerupted caries-free third molars were collected from patients. Deep Class I preparations were prepared in the extracted third molars, and the molars were then divided into 2 halves buccolingually. One-half was restored with the conventional technique (etch-and-rinse adhesive/resin composite), and the other half was treated with 2% chlorhexidine after being acid etched before restoration. The molars were then stored in artificial saliva with/without protease inhibitors. Under SEM, microtensile bond strengths

Dentin bond strength

Clinical Practice Point
Chlorhexidine preserves dentin bond strength

and failure mode distribution were analyzed immediately after the initial preparation and 6 months later.

The results showed that there was significantly better preservation of bond strength after 6 months with chlorhexidine; protease inhibitors in the storage medium had no effect. Compared with controls after 6 months, failure analysis showed significantly less failure in the hybrid layer with chlorhexidine. The results of this in vitro study suggest that application of chlorhexidine after acid etching might be useful for the preservation of dentin bond strength.

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Adhesives

Reis A F, Bedran-Russo A K B, Giannini M, Pereira P N R. Interfacial ultramorphology of single-step adhesives: nanoleakage as a function of time. *J Oral Rehabil* 34(3):213–221, 2007.

Clinical Practice Point

Microleakage in adhesive systems

This study compared the ability of 3 single-step adhesive systems to prevent nanoleakage over time. Third molar specimens were sectioned horizontally and used to test the experimental bonding agents. The agents tested were: Adper Prompt L-Pop, iBond and Clearfil Tri-S Bond. Low viscosity composite was used to accommodate the thin sections needed for TEM analysis.

The specimens were stored in water for 1, 60, or 90 days. After being stored in water, specimens were placed in a silver nitrate solution for 24 hours to allow for measurements of microleakage. The 3 materials varied in microleakage both in comparison and over time.

Prompt L-Pop demonstrated the lowest leakage at 24 hours but increased significantly at 60 and 90 days. The iBond adhesive had the most microleakage at 24 hours but increased only slightly at 60 and 90 days. The Clearfil Tri-S Bond produced the lowest overall microleakage.

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Implant placement

Nkenke E, Eitner S, Radespiel-Tröger M, Vairaktaris E, Neukam FW, Fenner M. Patient-centred outcomes comparing transmucosal implant placement with an open approach in the maxilla: a prospective, non-randomized pilot study. *Clin Oral Implants Res* 8(2):197–203, 2007.

Clinical Practice Point

Patients prefer transmucosal approach for implants
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This is a non-randomized prospective cohort study aimed at evaluating from a patient's perspective the relative morbidity of

implant placement transmucosally versus traditional flap design. Ten patients were enrolled in the study and were separated into a control group, which received a two-stage implant placement with a flap and allowed a 6-month healing time, and a test group.

The test group was evaluated with a CT image followed by virtual implant planning, and CAD/CAM surgical guides were made. These patients received implants transmucosally and were immediately loaded. On the day of surgery, day 1, and at day 7, all patients were asked to rate their pain on a visual analog scale.

At day 1 and at day 7 the test group patients were asked to respond to the following questions: Would you have this procedure done again? Did you recognize bleeding during surgery? Was the duration of surgery acceptable? Would you recommend this procedure to a friend? Pain and discomfort were rated significantly lower for the test group.

Patients in the test group all responded more favorably to the questionnaire than the control group. It was noted that the transmucosal approach lead to less post-operative edema. The authors also concluded that the transmucosal approach required more time to plan than did the traditional open flap surgical protocol.

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Liskmann S, Vihalemm T, Salum O, Zilmer K, Fischer K, Zilmer M. Characterization of the antioxidant profile of human saliva in peri-implant health and disease. Clin Oral Implants Res 18(1):27–33, 2007.

This article measured the levels of various antioxidants in saliva and compared values between healthy and diseased patients to attempt to identify possible contributing antioxidant factors in peri-implantitis.

Thirty patients with mandibular 2 implant supported complete dentures participated and were screened for non-smoking status, the same soft tissue biotype, no active stomatitis, no recent antibiotic use or need for antibiotic prophylaxis, and normal salivary flow. Saliva was collected after stimulation with citric acid and while at rest (unstimulated). Sialochemical analysis was used to measure myeloperoxidase activity, uric and ascorbic acid concentration, and antioxidant status.

This study found greater myeloperoxidase activity in patients with peri-implantitis. Ascorbic and uric concentrations were lower

Peri-implantitis

Clinical Practice Point
Antioxidant levels reveal peri-implant tissue health

in patients with peri-implantitis, as was total antioxidant activity. This study, though cross sectional, suggests a relationship between oxidase activity and peri-implant health. Longitudinal studies will be needed to obtain a cause and effect relationship.

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Framework fit

Al-Fadda SA, Zarb GA, Finer Y. A comparison of the accuracy of fit of 2 methods for fabricating implant-prosthetic frameworks. Int J Prosthodont 20(2):125–31, 2007.

This study compared the accuracy of fit of conventional cast frameworks to in vitro 3-dimensional (3D) accuracy of fit of laser-scanned Computer Numeric Controlled (CNC)-milled implant titanium frameworks. Nine master casts were chosen from completely edentulous patients treated with 5 mandibular implant-supported prostheses. Cast frameworks were fabricated following the well-established conventional technique, and then they were laser scanned, and CNC-milled titanium frameworks matching their outline were fabricated.

A contact-type coordinate measuring machine and specially developed computer program were used to measure the accuracy of fit of both framework types. Compared to conventional frameworks, the laser-scanned CNC-milled frameworks showed significantly less distortion along the x-axis and also revealed significantly less distortion on the horizontal plane compared with the conventional frameworks. The sagittal and vertical axes and total 3D distortion also showed less distortion in the laser-scanned CNC-milled frameworks, however this was not statistically significant.

The results of this study showed that fabrication of an implant-prosthetic framework using the CNC milling technique yielded a more accurate fit than the well-established conventional fabrication technique. However, further in vivo studies need to be performed in order to investigate the clinical significance of this recorded difference.

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Implant stress

Tanino F, Hayakawa I, Hirano S, Minakuchi S. Finite element analysis of stress-breaking attachments on maxillary implant-retained overdentures. Int J Prosthodont 20:193–198, 2007.

Studies have suggested that an open palate maxillary denture is best to retain oral sensation versus the traditional complete denture with full-palatal coverage. However, issues with stability and retention of an open-palate prosthesis make the implant-retained overdenture an attractive option.

Clinical Practice Point
Framework fit enhanced with milling process

Clinical Practice Point
Open palate denture function advanced

The present study was designed to analyze the effect of stress-breaking attachments on stress distribution with a maxillary palateless implant-retained overdenture using finite element analysis. The goal of the modeling simulation was to analyze the effect of stress-breaking attachments at the connection between the implant and overdenture on the stress generated at the implant-bone interface under loading during mastication and also on the cortical bone of the ridge just under the loading point.

Three-dimensional finite analysis models were constructed of a human maxilla and an overdenture seated on either 2 implants (in the canine areas) or 4 implants (in the canine and second premolar areas). Stress-breaking material between the implant and denture was included around each abutment. The modulus of elasticity of the stress-breaking material was varied from 1–3,000 MPa and the thickness was tested at 1–3 mm during the simulation. The maximum stress was calculated at both the implant-bone interface and the cortical bone surface just under the loading point.

In all situations tested, the maximum stress at the implant-bone interface occurred at the peri-implant bone on the loading side. As the elastic modulus of the stress-breaking material increased, the stress decreased at the cortical bone surface but increased at the implant-bone interface. When the 3 mm thick stress-breaking material was tested, the stress was less at the implant-bone interface compared with the 1mm thick material.

The results of this finite element analysis suggest that the stresses generated at the implant-bone interface could be controlled via alteration of the elastic modulus and thickness of the stress-breaking material in an implant-retained maxillary overdenture situation.

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Degidi M, Piattelli A, Iezzi G, Carinci F. Retrospective study of 200 immediately loaded implants retaining 50 mandibular overdentures. Quintessence Int 38(4):281–288, 2007.

The purpose of this study was to carry out a retrospective study on immediately loaded implants supporting mandibular overdentures (MODs). Fifty patients who each had 4 implants in the interforaminal area, rigidly connected with a U-shaped bar and then loaded with a mandibular overdenture, were selected for this retrospective study. Implant diameter and length ranged from 3.4–5.5 mm and from 10.0–18.0 mm, respectively.

Immediately loaded implants

Clinical Practice Point
Immediate implant denture loading reliability

Sixty implants were placed after extraction, and bone quality was D1 in 22 cases and D2 in 178 cases. The mean post-loading follow-up was 43 months. Among these patients, no implants were lost (i.e., survival rate, 100%) and no statistical differences were detected among the studied variables. Therefore, no or reduced crestal bone resorption was considered an indicator of the success rate to evaluate the effect of several host-, surgery-, and implant-related factors.

A general linear model was then performed to detect those variables statistically associated with crestal bone resorption. No implants were lost after a mean postloading follow-up of 43 months, and thus no differences were detected among the studied variables. In contrast, the general linear model showed that longer (i.e., length > 13.0 mm) and wider (i.e., diameter > 3.75 mm) implants and implant type (Frialoc and XiVE TG) are correlated with a lower crestal bone resorption and therefore a better outcome.

The results of this study showed that immediate loading of implants retaining a mandibular overdenture is a reliable method that can reduce the length of prosthetic rehabilitation without compromising the outcome of implants.

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TMJ degeneration

Cledes G, Felizardo R, Foucart JM, Carpentier P. Validation of a chemical osteoarthritis model in rabbit temporomandibular joint: a compliment to biomechanical models. Int J Oral Maxillofac Surg 35(11):1026-1033, 2006.

This study applied a known knee joint chemical model of degenerative joint disease to the TMJ to follow the histological process of TMJ degeneration.

Sodium mono-iodoacetate (MIA) was used to induce degenerative changes in the TMJ of 12 adult white rabbits. The MIA was injected into the lower joint compartment to induce only mild progression and to follow human clinical involvement of mostly the condylar cartilage.

Lesions of the condylar cartilage occurred primarily in the anterior and central areas and were more severe in medial aspect. At 10 days, the condylar cartilage thickened again and was more pronounced in the medial side. At 20 days, the cartilage was thinned all over and replaced with a fibrous tissue medially. At 30 days, it was replaced entirely with the fibrous tissue. At 40 days, there was an erosion, leaving subchondral bone exposed to the joint cavity. At 20 days, the subchondral bone showed resorption and was being

Clinical Practice Point
Model of TM joint degeneration

replaced by a highly cellular conjunctive tissue. After 30 days, the subchondral bone was locally exposed to the joint cavity and almost fully replaced by an acellular conjunctival tissue. At 40 days, the subchondral and chondroid bone was fully exposed to the articular cavity. All experimental joints demonstrated a fibrosis and hyperplasia of the synovial membrane.

This study demonstrated a successful attainment of joint degeneration with the injection of MIA into the joint cavity. This model may be applied to enhance the understanding of joint degeneration when used with other biomechanical models.

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Pongnarisorn NJ, Gemmell E, Tan AE, Henry PJ, Marshall RI, Seymour GJ. Inflammation associated with implants with different surface types. Clin Oral Implants Res 18(1):114–125, 2007.

The goal of this study was to evaluate the inflammatory process associated with different surfaces on the trans-mucosal element of one-stage implants. Eight grey hound dogs were used in this study. Single stage TiUnite implants with four different trans-mucosal surfaces were used: acid-etch, machined, machined with a circumferential groove, and oxidized.

At 6 months, biopsies were conducted and evaluated histologically. All peri-implant tissues were free from clinical signs of inflammation. Histologically, all peri-implant tissues exhibited some signs of inflammation. T cells were a more common infiltrate than B cells or macrophages.

This study found little difference in the peri-implant tissue between surface types. In the absence of clinical signs of inflammation, the histological findings support peri-implantitis being a peri-implant mucositis and is a plaque associated disease rather than surface.

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Santini A, Ivanovic V, Chuei LT, Ibbetson R. Effect of prolonged thermal cycling on microleakage around Class V cavities restored with glass-ceramic inserts with different coefficients of thermal expansion: an in vitro study. Prim Dent Care 13(4):147–153, 2006.

Currently, the polymerization shrinkage of composite restorative materials is a persistent impediment to the long-term performance of the restoration. Clinically, leakage and failure occur when

Implant inflammation

Clinical Practice Point
Surface texture of implant has little effect on tissues

Polymerization shrinkage

Clinical Practice Point
Temperature change and microleakage

the contraction stresses exceed the adhesive force of composite to the tooth substrate.

Glass-ceramic insert systems are marketed as “mega fillers” that allow a reduction in RBC volume with a related reduction in polymerization shrinkage. Studies report conflicting results regarding improvements in micro-leakage and shrinkage when these inserts are used for Class II and V restorations.

The present study evaluated microleakage around Class V glass-ceramic restorations of different coefficients of thermal expansion (CTE) after prolonged *in vitro* thermal cycling. The goal was to determine whether or not a difference in the CTE of glass-ceramic inserts, luted with a high-viscous composite, influenced the marginal seal around standardized Class V restorations after prolonged thermal cycling. Class V preparations were made with butt joints in 120 noncarious extracted human premolars. Glass-ceramic inserts from 2 manufacturers were used to restore the cavity preparations, and a control group was bulk-filled with the luting composite. Sixty teeth selected randomly were thermo-cycled 4000 times between water baths.

No significant difference at gingival or occlusal preparation margins was detected between the 3 groups ($P > 0.5$) without thermal cycling. After thermal cycling, microleakage at the occlusal margins was significantly less around preparations restored with Cerana glass-ceramic inserts versus Beta-Quartz and Tetric Ceram ($P < 0.05$). Thermal cycling had no significant effect on the Cerana inserts ($P = 0.5590$). The Cerana glass-ceramic inserts have a CTE approximate to that of enamel and performed better than other materials tested when subjected to thermal cycling.

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Interforaminal implants

Lambrecht JT, Hodel Y. Long-term results of immediately loaded interforaminal implants. Quintessence Int 38(2):111–119, 2007.

Clinical Practice Point

Four month implant healing period questioned
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The purpose of this retrospective study was to collect long-term results from patients who received immediately loaded Straumann implants with bar-retained overdentures.

Between 1981 and 1991, 4 one-piece Straumann implants were interforaminally implanted into the mandibles of 44 patients. In addition, on the day of the operation, each of the patients was fitted with a bar that was immediately loaded with a hybrid prosthesis. Follow-up evaluations took place between 1999 and 2000.

Among the 44 patients who received 176 interforaminal Straumann implants (4 implants per patient), 23 (10 women, 13 men, ages ranging from 58–98 years) were available to be clinically re-examined and statistically assessed. The mean observation time for the implants was 12.2 years (8–18 years). The implants were evaluated according to the following criteria: plaque index, gingival index, probing depth, bleeding on probing, periotest, and radiographs. The evaluations showed that 3 implants were lost and 5 implants did not meet the predetermined success criteria because they showed Periotest values of 0 or greater with a circular radiolucency. Under the definition by Cutler and Ederer, the probability of success was 83.3%.

According to these results, it was suggested that in patients who are edentulous in the mandible, Straumann implants in the interforaminal region that are fitted with bars and immediately loaded can provide acceptable long-term results over a period of almost 20 years. Therefore, it appears that the requisite 4-month healing time for immediately loaded interforaminal Straumann implants with bars does not have to be observed.

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Schmitter M, Rammelsberg P, Gabbert O, Ohlmann B. Influence of clinical baseline findings on the survival of 2 post systems: a randomized clinical trial. Int J Prosthodont 20:173–178, 2007.

A clinical trial was initiated to compare 2 types of endodontic post systems: fiber-reinforced posts (FRPs) and serrated metal screw posts (MSPs). It was hypothesized that both clinical baseline characteristics and the individual post system would influence results.

Subjects (100) were recruited with teeth that had been treated endodontically at least 3 months prior to restoration and were in need of reconstruction due to destruction of over 40% of the crown. Treated teeth received single crowns, a fixed partial denture or supported a removable partial denture. The FRP post system used was the ER-dentin post, Brasseler, and parallel-sided titanium screw posts, BKS Brasseler, were chosen as the MSP, with only 1 post per tooth included in the study.

One year post-placement, 46 subjects with FRPs completed the study, and the survival rate of the FRP was 93.5%. One failure required re-cementation of the post, one involved a cracked crown,

Two post systems

Clinical Practice Point
Fiber-reinforced posts integrity revealed

and the third tooth showed apical alteration. No specific risk factors for failure were found in the FRP group.

Forty-five subjects with MSPs completed the study, with a survival rate of 77.8%. The 11 failures included 7 extractions due to root fracture at the apical end of the post (4), buccal lingual perforations (2), and 1 with a post fracture. Only 1 tooth showed apical alterations. One post, 1 crown and 1 post and crown complex had to be re-cemented. Using regression analysis to evaluate tooth risk factors for failure in MSPs, 2 variables were implicated: degree of remaining coronal tooth structure and tooth location. Teeth with more decay and anterior teeth had a higher risk of fracture with the MSP systems.

Based on the short-term clinical performance of each of the post systems, the FRP system was superior to the MSP, and its survival was additionally independent of tooth location and degree of coronal destruction.

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Evidence-based diagnosis

Clinical Practice Point

Challenges with evidence-based clinical practice
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Turp JC, Heydecke G, Krastl G, Pontius O, Zitzmann N. Restoring the fractured root-canal treated maxillary lateral incisor: in search of an evidence-based approach. Quintessence Int 38:179–191, 2007.

This paper highlights the variability in evidence-based diagnosis in dentistry. The following case was given to 4 dental specialists for evidence-based recommendations: The pulp chamber in a maxillary right lateral incisor was exposed during caries excavation in 1976 on a 15-year-old male. After root-canal treatment, the tooth remained symptom-free for 30 years. Non-vital bleaching occurred in 1993 and 1998, and the access opening was restored with composite. In 2005, the clinical crown of the tooth broke off 1 mm above the gingival margin. The tooth was immediately endodontically re-treated, the crown fragment abraded, etched and then luted back onto the root.

The endodontist recommended a cast post and core to be restored with a porcelain-fused-to-metal (PFM) crown. This procedure was considered less invasive than an implant and more proven in randomized clinical trials than the quartz fiber flexible posts. Also cited was the undesirable failure mode of the cast post and core.

Both the prosthodontist and operative dentist recommended a tooth-colored glass fiber post/fiber-reinforced resin composite post be cemented to retain the broken tooth fragment. The failure mode of the resin post was deemed more favorable than that of a cast post.

The perio-prosthodontist recommended a PFM crown with either a direct composite core buildup or a cast post and core. The tooth was evaluated to be salvageable, but because almost all the clinical crown was involved in the fracture, a complete-coverage crown with additional internal retention from a core restoration was chosen to reduce the high risk of re-fracture or marginal leakage and subsequent bacterial infection.

Each specialist did evidence-based literature searches in assisting the suggested course of treatment, each relying on different articles as support; of the 73 articles, only 2 were chosen by more than 1 specialist, and a citation-analysis demonstrated that only 5 articles represented high-level evidence involving randomized controlled studies. The authors conclude that there is a lack of consensus about the best search strategies for obtaining high-level evidence-based articles to support clinical diagnosis.

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Stoker GT, Wismeijer D, van Waas MAJ. An eight-year follow-up to a randomized clinical trial of aftercare and cost-analysis with three types of mandibular implant-retained overdentures. J Dent Res 86(3):276–280, 2007.

For mandibular implant overdenture treatment to become a standard protocol, the costs of treatment and aftercare must be critically evaluated to provide complete and essential information to patients, health authorities, and third-party payers. The present study followed participants from a randomized clinical trial of 3 types of mandibular overdenture: 2 versus 4 implants and ball versus bar attachments, for 8 years after delivery of the appliance.

For each follow-up visit, the total chair time in minutes as well as the number of scheduled and unscheduled visits was recorded. Each patient was scheduled for biannual hygiene appointments, annual checks with the prosthodontist and evaluation by the oral surgeon every 2 years. The direct aftercare costs were tabulated for each patient by the hourly rate, and the costs of the dental technician by minutes of chair time. Indirect costs included loss of the patients' productive working hours or spare time, the use of medication, travel time, and environmental costs.

The initial treatment costs constituted 71–78% of the total costs during the eight-year period. These were significantly higher in the group with a bar on 4 implants, compared with the group with a bar on 2 implants and the group with ball attachments on 2 implants.

Implant-retained overdentures

Clinical Practice Point
Cost efficiency, patient satisfaction with mandibular implants examined

The group with ball attachments on 2 implants needed a significantly higher number of prosthodontist-patient aftercare contacts, mostly for re-adjustment of the retentive system, including re-activation of the matrices.

The results of the long-term clinical trial satisfaction study additionally found that patient satisfaction with the retention and stability of the mandibular implant-retained overdenture decreased significantly in the 2 implants-ball attachment group. Thus, it can be concluded that an overdenture with a single bar on 2 implants may be the most efficient in the long term.

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Bone grafts

Clinical Practice Point
Success with one step implant procedure with tissue engineered graft

Ito K, Yamada Y, Naiki T, Ueda M. Simultaneous implant placement and bone regeneration around dental implants using tissue-engineered bone with fibrin glue, mesenchymal stem cells and platelet-rich plasma. Clin Oral Implants Res 17(5):579-586, 2006.

The objective of this study was to evaluate histologically, using a canine model, the effect of a tissue engineered bone graft on the rate of bone formation and regeneration around dental implants in a 1-step procedure.

Twelve adult hybrid dogs were used in this study, having had the first molar as well as the first, second, and third premolars extracted from the mandible. Three bony defects on both sides were created. Four groups were created, using a 3.75 × 7 mm implant immediate placement, grafted with one of the following:

- 1) Fibrin glue (fibrin)
- 2) Dog mesenchymal stem cells and fibrin glue (dMSC/fibrin)
- 3) Dog mesenchymal stem cells, fibrin glue, and platelet-rich-plasma (dMSC/PRP/fibrin)
- 4) Nothing (control)

The prepared grafting solutions were injected around the dental implants at the time of surgery. The PRP demonstrated a 464% increase in concentration above base line. Macroscopic evaluation showed natural marginal bone level with the dMSC/fibrin and dMSC/fibrin/PRP but incomplete levels with the control and fibrin only groups.

At 8 weeks the control and fibrin groups demonstrated only partial regeneration around the implants. The dMSC/fibrin group demonstrated gradual mature bone regeneration. The dMSC/ fibrin/

PRP group demonstrated sufficient buccal bone regeneration as well as a mature lamellar structure. The bone-implant contact measured: 29% for the control, 25% for the fibrin, 42% for the dMSC/fibrin group, and 53% for the dMSC/fibrin/PRP group at the end of 8 weeks.

The results of this study suggest that the addition of growth factor through PRP into the graft site improves bone regeneration. Also suggested is the potential clinical success in the simultaneous placement of implant and injectable tissue-engineered bone grafts.

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Bernstein S, Cooke J, Fotek P, Wang H-L. Vertical bone augmentation: where are we now? *Implant Dent* 15(3):219–228, 2006.

The purpose of this article is to present a literature review of current techniques and successes for vertical ridge augmentation. Techniques reviewed in this article are: monocortical onlay graft, guided-bone regeneration, and distraction osteogenesis. Newer techniques with potential promise are also introduced.

Monocortical onlay graft is presented and focused on the 2 intraoral donor sites, the symphysis and ramus. The ramus graft tended to yield a graft that was longer but not as deep. The length of the ramus graft can be as much as 40 mm, with a height of 10–15 mm and a thickness of 3–5 mm. The symphysis graft was not as large, but significantly deeper. Selection of the 2 sites was based on the dimensions of the defect to be filled. The symphysis graft, however, consistently was reported to have a higher complication rate at the donor site. The ramus graft produced fewer complications, but it was more difficult to gain access and visibility. The use of membranes with onlay grafts carries with it the risk of incision line opening, significantly reducing the success of the graft. Implant success rates seem to be comparable to success rates of implants placed in nongrafted sites.

Gavriel Hizarov developed distraction osteogenesis. There are 3 phases to this process: latency, distraction, and consolidation. This technique can only be used in defects that have 6–7 mm of bone remaining above anatomical structures. A review of the literature suggested that a mean vertical gain of 7.45 mm is achievable. A success rate of 96.5% of implants placed in these areas was also reported.

Vertical ridge augmentation

Clinical Practice Point
Successful vertical ridge augmentation techniques reviewed

Guided bone regeneration employs the use of membranes to create space for bone regeneration. When only autogenic bone is used, greater vertical height can be accomplished. Averages of 4–8 mm are reported, with a 95.8% average survival rate of implants placed in this type of graft.

Several new techniques are discussed briefly. One technique is a type of distraction for the mandibular anterior where a horizontal segment is raised 5mm, held in place, and grafted with BioOss. Also, a floating alveolar device is discussed, which uses traditional vertical distraction technique, but a hinge is placed apically. This hinge gives a buccal rotation and expansion for horizontal bony augmentation. A different type of monocortical graft was done where a core of bone graft is placed into an osteotomy site, leaving the coronal portion above the crest, which resulted in average vertical gains of 4.5 mm.

The addition of bone morphogenetic protein has aided in vertical augmentations. Block allografts have recently been introduced, which potentially provide unlimited amounts with a decreased morbidity rate seen in autografts.

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