A clinical and histologic evaluation of implant integration in the posterior maxilla after sinus floor augmentation with autogenous bone, bovine hydroxyapatite, or a 20:80 mixture.

Hallman M, Sennerby L, Lundgren S.


Abstract

PURPOSE:

This study was designed to clinically and histologically evaluate the integration of titanium implants in different grafting materials used for maxillary sinus augmentation procedures.

MATERIALS AND METHODS:

A total of 21 patients and 36 maxillary sinuses were augmented with (1) autogenous particulated bone from the mandibular ramus, (2) bovine hydroxyapatite (BH) with membrane coverage, or (3) an 80/20 mixture of BH and autogenous bone. The grafts were allowed to heal for 6 to 9 months prior to placement of microimplants for histology and standard implants for prosthetic rehabilitation. After another 6 months of healing, when abutments were connected, the microimplants were retrieved for histologic and morphometric analyses. The outcome of the standard implants was clinically evaluated after 1 year of loading.

RESULTS:

The mean bone-implant contact was 34.6 +/- 9.5%, 54.3 +/- 33.1%, and 31.6 +/- 19.1% for autogenous bone, mixture of 20% autogenous bone/80% BH, and 100% BH, respectively. The corresponding values for the bone area parameter were 37.7 +/- 31.3%, 39.9 +/- 8%, and 41.7 +/- 26.6%. The BH area was found to be 12.3 +/- 8.5% and 11.8 +/- 3.6% for 20% autogenous bone/80% BH and 100% BH, respectively. There were no statistically significant differences for any parameter between any of the groups. After 1 year of loading, 6 of the 33 implants placed in autogenous bone grafts, 2 of the 35 implants placed in the BH/autogenous bone mixture, and 2 of 43 implants placed in BH were lost. There were no statistically significant differences between any of the groups.

DISCUSSION:

The histomorphometric analysis showed no differences between the 3 groups, indicating that autogenous bone graft can be substituted with bovine hydroxyapatite to 80% or 100% when used for maxillary sinus floor augmentation. The effect of adding autogenous bone remains unclear but may allow for a reduction of the healing time.

CONCLUSION:
The results from this clinical and histologic study indicate that similar short-term results can be expected when using autogenous bone, BH, or a mixture of them for maxillary sinus floor augmentation and delayed placement of dental implants.

**Bone augmentation procedures in localized defects in the alveolar ridge: clinical results with different bone grafts and bone-substitute materials.**

Jensen SS, Terheyden H.


**Abstract**

**PURPOSE:**

The objective of this review was to evaluate the efficacy of different grafting protocols for the augmentation of localized alveolar ridge defects.

**MATERIALS AND METHODS:**

A MEDLINE search and an additional hand search of selected journals were performed to identify all levels of clinical evidence except expert opinions. Any publication written in English and including 10 or more patients with at least 12 months of follow-up after loading of the implants was eligible for this review. The results were categorized according to the presenting defect type: (1) dehiscence and fenestration-type defects, (2) horizontal ridge augmentations, (3) vertical ridge augmentations, and (4) maxillary sinus floor elevations using the lateral window technique or transalveolar approach. The review focused on: (1) the outcome of the individual grafting protocols and (2) survival rates of implants placed in the augmented bone.

**RESULTS AND CONCLUSION:**

Based on 2,006 abstracts, 424 full-text articles were evaluated, of which 108 were included. Eleven studies were randomized controlled clinical trials. The majority were prospective or retrospective studies including a limited number of patients and short observation periods. The heterogeneity of the available data did not allow identifying one superior grafting protocol for any of the osseous defect types under investigation. However, a series of grafting materials can be considered well-documented for different indications based on this review. There is a high level of evidence (level A to B) to support that survival rates of implants placed in augmented bone are comparable to rates of implants placed in pristine bone.
Clinical and histologic comparison of two different composite grafts for sinus augmentation: a pilot clinical trial.


Abstract

BACKGROUND AND OBJECTIVES:

Sinus augmentation is a procedure used for augmenting insufficient bone height that is often observed in the maxillary posterior areas. Many different techniques as well as bone graft regimens have been suggested for performing this procedure. It was the goal of this study to compare, clinically and histologically, two different composite grafting regimens used for sinus augmentation.

MATERIAL AND METHODS:

Five patients, needing a bilateral sinus augmentation to allow implant placement, were recruited for this study. Right sinuses were grafted with cortical bone (collected from overlying the sinus membrane) and bovine hydroxyapatite (HA), while the left side sinuses were grafted with overlying autologous bone plus a bioglass (BG) material. Bone core biopsies were taken at 6 months after sinus graft or at the time of implant insertion. A waiting period of 6 additional months was granted to allow healing, before prosthetic restoration and functional loading. The level of peri-implant bone was evaluated 12 months after loading. A comparative histomorphometric analysis was conducted and a statistical analysis was performed.

RESULTS:

All implants in both groups were functional after a 12-month loading period. No bone loss was observed radiographically or clinically in both groups. Histologic analysis revealed that both composite grafts had a high biocompatibility. In the bovine HA-containing group, minimal xenogenic graft absorption was noted. In contrast, BG group samples presented a high absorption rate with some remaining particles imbedded in new normal bone.

CONCLUSIONS:

Sinus augmentation using a combination of autogenous bone plus either bovine HA or BG is a predictable technique.
Clinical outcomes of sinus floor augmentation for implant placement using autogenous bone or bone substitutes: a systematic review.

Nkenke E, Stelzle F.


Abstract

BACKGROUND:

To date, there are still no clear cut guidelines for the use of autogenous bone or bone substitutes.

AIM:

The aim of the present review was to analyze the current literature in order to determine whether there are advantages of using autogenous bone (AB) over bone substitutes (BS) in sinus floor augmentation. The focused question was: is AB superior to BS for sinus floor augmentation in partially dentate or edentulous patients in terms of implant survival, patient morbidity, sinusitis, graft loss, costs, and risk of disease transmission?

MATERIALS AND METHODS:

The analysis was limited to titanium implants with modified surfaces placed in sites with 6 mm of residual bone height and a lateral wall approach to the sinus. A literature search was performed for human studies focusing on sinus floor augmentation.

RESULTS:

Twenty-one articles were included in the review. The highest level of evidence consisted of prospective cohort studies. A descriptive analysis of the constructed evidence tables indicated that the type of graft did not seem to be associated with the success of the procedure, its complications, or implant survival. Length of healing period, simultaneous implant placement or a staged approach or the height of the residual alveolar crest, sinusitis or graft loss did not modify the lack of effect of graft material on the outcomes. Three studies documented that there was donor site morbidity present after the harvest of AB. When iliac crest bone was harvested this sometimes required hospitalization and surgery under general anesthesia. Moreover, bone harvest extended the operating time. The assessment of disease transmission by BS was not a topic of any of the included articles.

DISCUSSION AND CONCLUSION:

The retrieved evidence provides a low level of support for selection of AB or a bone substitute. Clear reasons could not be identified that should prompt the clinician to prefer AB or BS.
Interventions for replacing missing teeth: bone augmentation techniques for dental implant treatment.

Esposito M, Grusovin MG, Kwan S, Worthington HV, Coulthard P.


Source

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Update in


Abstract

BACKGROUND:

Dental implants require sufficient bone to be adequately stabilised. For some patients implant treatment would not be an option without bone augmentation. A variety of materials and surgical techniques are available for bone augmentation.

OBJECTIVES:

General objectives: To test the null hypothesis of no difference in the success, function, morbidity and patient satisfaction between different bone augmentation techniques for dental implant treatment. Specific objectives: (A) to test whether and when augmentation procedures are necessary; (B) to test which is the most effective augmentation technique for specific clinical indications. Trials were divided into three broad categories according to different indications for the bone augmentation techniques: (1) major vertical or horizontal bone augmentation or both; (2) implants placed in extraction sockets; (3) fenestrated implants.

SEARCH STRATEGY:

The Cochrane Oral Health Group's Trials Register, the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE and EMBASE were searched. Several dental journals were handsearched. The bibliographies of review articles were checked, and personal references were searched. More than 55 implant manufacturing companies were also contacted. Last electronic search was conducted on 9th January 2008.

SELECTION CRITERIA:

Randomised controlled trials (RCTs) of different techniques and materials for augmenting bone for implant treatment reporting the outcome of implant therapy at least to abutment connection.

DATA COLLECTION AND ANALYSIS:

Screening of eligible studies, assessment of the methodological quality of the trials and data extraction were conducted independently and in duplicate. Authors were contacted for any missing information. Results were expressed as random-effects models using mean
differences for continuous outcomes and odd ratios for dichotomous outcomes with 95% confidence intervals. The statistical unit of the analysis was the patient.

MAIN RESULTS:

Seventeen RCTs out of 40 potentially eligible trials reporting the outcome of 455 patients were suitable for inclusion. Since different techniques were evaluated in different trials, no meta-analysis could be performed. Ten trials evaluated different techniques for vertical or horizontal bone augmentation or both. Four trials evaluated different techniques of bone grafting for implants placed in extraction sockets and three trials evaluated different techniques to treat bone dehiscence or fenestrations around implants.

AUTHORS’ CONCLUSIONS:

Major bone grafting procedures of resorbed mandibles may not be justified. Bone substitutes (Bio-Oss or Cerasorb) may replace autogenous bone for sinus lift procedures of atrophic maxillary sinuses. Various techniques can augment bone horizontally and vertically, but it is unclear which is the most efficient. It is unclear whether augmentation procedures at immediate single implants placed in fresh extraction sockets are needed, and which is the most effective augmentation procedure, however, sites treated with barrier plus Bio-Oss showed a higher position of the gingival margin when compared to sites treated with barriers alone. Non-resorbable barriers at fenestrated implants regenerated more bone than no barriers, however it remains unclear whether such bone is of benefit to the patient. It is unclear which is the most effective technique for augmenting bone around fenestrated implants. Bone morphogenetic proteins may enhance bone formation around implants grafted with Bio-Oss. Titanium may be preferable to resorbable screws to fixate onlay bone grafts. The use of particulate autogenous bone from intraoral locations, also taken with dedicated aspirators, might be associated with an increased risk of infective complications. These findings are based on few trials including few patients, sometimes having short follow up, and often being judged to be at high risk of bias.

The efficacy of various bone augmentation procedures for dental implants: a Cochrane systematic review of randomized controlled clinical trials.

Esposito M, Grusovin MG, Coulthard P, Worthington HV.


Abstract

PURPOSE:

To test (a) whether and when bone augmentation procedures are necessary and (b) which is the most effective augmentation technique for specific clinical indications. Trials were divided into 3 categories: (1) major vertical or horizontal bone augmentation (or both); (2) implants placed in extraction sockets; (3) fenestrated implants.

MATERIALS AND METHODS:

An exhaustive search was conducted for all randomized controlled clinical trials (RCTs) comparing different techniques and materials for augmenting bone for implant treatment
reporting the outcome of implant therapy at least to abutment connection. No language restriction was applied. The last electronic search was conducted on October 1, 2005.

RESULTS:

Thirteen RCTs of 30 potentially eligible trials reporting the outcome of 332 patients were suitable for inclusion. Six trials evaluated techniques for vertical and/or horizontal bone augmentation. Four trials evaluated techniques of bone grafting for implants placed in extraction sockets, and 3 trials evaluated techniques to treat fenestrated implants.

CONCLUSIONS:

Major bone grafting procedures of extremely resorbed mandibles may not be justified. Bone substitutes may replace autogenous bone for sinus lift procedures of extremely atrophic sinuses. Both guided bone regeneration procedures and distraction osteogenesis can be used to augment bone vertically, but it is unclear which is the most efficient. It is unclear whether augmentation procedures are needed at immediate single implants placed in fresh extraction sockets; however, sites treated with barrier + Bio-Oss showed a higher position of the gingival margin than sites treated with barriers alone. More bone was regenerated around fenestrated implants with nonresorbable barriers than without barriers; however, it remains unclear whether such bone is of benefit to the patient. Bone morphogenetic proteins may enhance bone formation around implants grafted with Bio-Oss, but there was no reliable evidence supporting the efficacy of other active agents, such as platelet-rich plasma, in conjunction with implant treatment.

Carbon dioxide laser and hydrogen peroxide conditioning in the treatment of periimplantitis: an experimental study in the dog.

Persson LG, Mouhyi J, Berglundh T, Sennerby L, Lindhe J.


BACKGROUND:

Various methods have been applied for the treatment of periimplantitis lesions. It has been reported that the procedures used have been effective in eliminating the inflammatory lesion but that re-osseointegration to the once-contaminated implant surface has been difficult or impossible to achieve.

PURPOSE:

The aim of this study was to examine the use of carbon dioxide (CO2) laser in combination with hydrogen peroxide in the treatment of experimentally induced periimplantitis lesions.

MATERIALS AND METHODS:

Three dental implants (ITI Dental Implant System, Straumann AG, Waldenburg, Switzerland) were placed in each side of the edentulous mandible of four beagle dogs. Implants with a turned surface and implants with a sand-blasted large-grit acid-etched (SLA) surface (SLA, Straumann AG, Waldenburg, Switzerland) were used. Experimental periimplantitis was induced during 3 months. Five weeks later each animal received tablets of amoxicillin and
metronidazole for a period of 17 days. Three days after the start of the antibiotic treatment, full-thickness flaps were elevated, and the granulation tissue in the bone craters was removed. In the two anterior implant sites in both sides of the mandible, a combination of CO2 laser therapy and application of a water solution of hydrogen peroxide was used. The implant in the posterior site of each quadrant was cleaned with cotton pellets soaked in saline. Biopsy specimens were obtained 6 months later.

RESULTS:

The amount of re-osseointegration was 21% and 82% at laser-treated turned-surface implants and SLA implants, respectively, and 22% and 84% at saline-treated turned-surface implants and SLA implants, respectively.

CONCLUSIONS:

The present study demonstrated the following: (1) a combination of systemic antibiotics and local curettage and debridement resulted in the resolution of experimentally induced periimplantitis lesions; (2) at implants with a turned surface, a small amount of re-osseointegration was observed at the base of the bone defects whereas a considerable amount of re-osseointegration occurred at implants with an SLA surface; and (3) the use of CO2 laser and hydrogen peroxide during surgical therapy had no apparent effect on bone formation and re-osseointegration.

Interventions for replacing missing teeth: augmentation procedures of the maxillary sinus.


Abstract

BACKGROUND:

Insufficient bone volume is a common problem encountered in the rehabilitation of the edentulous posterior maxillae with implant-supported prostheses. Bone volume is limited by the presence of the maxillary sinus together with loss of alveolar bone height. Sinus lift procedures increase bone volume by augmenting the sinus cavity with autogenous bone and/or commercially available biomaterials.

OBJECTIVES:

To determine whether and when augmentation of the maxillary sinus are necessary and which are the most effective augmentation techniques for rehabilitating patients with implant-supported prostheses.

SEARCH STRATEGY:

The Cochrane Oral Health Group's Trials Register, CENTRAL, MEDLINE and EMBASE were searched on 7th January 2010. Several dental journals were handsearched.
bibliographies of review articles were checked, and personal references were searched. More than 55 implant manufacturing companies were also contacted.

**SELECTION CRITERIA:**

Randomised controlled trials (RCTs) of different techniques and materials for augmenting the maxillary sinus for rehabilitation with dental implants reporting the outcome of implant success/failure at least to abutment connection.

**DATA COLLECTION AND ANALYSIS:**

Screening of eligible studies, assessment of the methodological quality of the trials and data extraction were conducted independently and in duplicate. Authors were contacted for any missing information. Results were expressed as random-effects models using mean differences for continuous outcomes and odds ratios for dichotomous outcomes with 95% confidence intervals. The statistical unit of the analysis was the patient.

**MAIN RESULTS:**

Ten RCTs out of 29 met the inclusion criteria. One trial of 15 patients evaluated implants 5 mm long with 6 mm diameter as an alternative to sinus lift in bone with a residual height of 4 to 6 mm. Nine trials with 235 patients compared different sinus lift techniques; of these four trials (114 patients) evaluated the efficacy of platelet-rich plasma (PRP). Due to the variety of techniques evaluated, meta-analysis was only possible of use of PRP for implant failure (two trials) and complications (three trials). No statistically significant difference was observed.

**AUTHORS’ CONCLUSIONS:**

Conclusions are based on few small trials, with short follow-up, and judged to be at high risk of bias. Therefore conclusions should be viewed as preliminary and interpreted with great caution. It is still unclear when sinus lift procedures are needed. 5 mm short implants can be successfully loaded in maxillary bone with a residual height of 4 to 6 mm but their long-term prognosis is unknown. Elevating the sinus lining in presence of 1 to 5 mm of residual bone height without the addition of a bone graft may be sufficient to regenerate new bone to allow rehabilitation with implant-supported prostheses. Bone substitutes might be successfully used as replacements for autogenous bone. If the residual alveolar bone height is 3 to 6 mm a crestal approach to lift the sinus lining, to place 8 mm implants may lead to fewer complications than a lateral window approach, to place implants at least 10 mm long. There is no evidence that PRP treatment improves the clinical outcome of sinus lift procedures with autogenous bone or bone substitutes.
Vertical ridge augmentation of the atrophic posterior mandible with interpositional bloc grafts: bone from the iliac crest vs. bovine anorganic bone. Clinical and histological results up to one year after loading from a randomized-controlled clinical trial.


Abstract

OBJECTIVES:

To compare two different techniques for vertical bone augmentation of the posterior mandible: bone blocs from the iliac crest vs. anorganic bovine bone blocs used as inlays.

MATERIALS AND METHODS:

Ten partially edentulous patients having 5-7 mm of residual crestal height above the mandibular canal had their posterior mandibles randomly allocated to both interventions. After 4 months implants were inserted, and after 4 months, provisional prostheses were placed. Definitive prostheses were delivered after 4 months. Histomorphometry of samples trephined at implant placement, prosthesis and implant failures, any complication after loading and peri-implant marginal bone-level changes were assessed by masked assessors. All patients were followed up to 1 year after loading.

RESULTS:

Four months after bone augmentation, there was statistically significant more residual graft (between 10% and 13%) in the Bio-Oss group. There were no statistically significant differences in failures and complications. Two implants could not be placed in one patient augmented with autogenous bone because the graft failed whereas one implant and its prosthesis of the Bio-Oss group failed after loading. After implant loading only one complication (peri-implantitis) occurred at one implant of the autogenous bone group. In 16 months (from implant placement to 1 year after loading), both groups lost statistically significant amounts of peri-implant marginal bone: 0.82 mm in the autogenous bone group and 0.59 mm in the Bio-Oss group; however, there were no statistically significant differences between the groups.

CONCLUSIONS:

Both procedures achieved good results, but the use of bovine blocs was less invasive and may be preferable than harvesting bone from the iliac crest.

Bone substitutes and growth factors as an alternative/complement to autogenous bone for grafting in implant dentistry.


Hallman M, Thor A.
Meta-analytic study of implant survival following sinus augmentation.


Abstract

OBJECTIVES:

To evaluate graft types used for maxillary sinus augmentation and review success rates of dental implants inserted in these areas, analyzing the graft materials used, implant surface types and the moment of implant placement.

STUDY DESIGN:

A meta-analytic study reviewing articles on sinus augmentation published during the last ten years.

RESULTS:

3,975 implants placed in sinus augmentations (with bony windows) were registered, of which 3,749 implants survived, a survival rate of 94.3%.

CONCLUSIONS:

When performing sinus augmentation, bone substitute materials are just as effective as autologous bone, whether used alone or in combination with autologous bone. Implant surface treatments can have an important effect on implant survival and it would appear that roughened surfaces are the best option. When implants are inserted simultaneously to grafting, a higher failure rate can be expected.

Which hard tissue augmentation techniques are the most successful in furnishing bony support for implant placement?
Aghaloo TL, Moy PK.


Abstract

PURPOSE:

A variety of techniques and materials have been used to establish the structural base of osseous tissue for supporting dental implants. The aim of this systematic review was to identify the most successful technique(s) to provide the necessary alveolar bone to place a dental implant and support long-term survival.

METHODS:
A systematic online review of a main database and manual search of relevant articles from refereed journals were performed between 1980 and 2005. Updates and additions were made from September 2004 to May 2005. The hard tissue augmentation techniques were separated into 2 anatomic sites, the maxillary sinus and alveolar ridge. Within the alveolar ridge augmentation technique, different surgical approaches were identified and categorized, including guided bone regeneration (GBR), onlay/veneer grafting (OVG), combinations of onlay, veneer, interpositional inlay grafting (COG), distraction osteogenesis (DO), ridge splitting (RS), free and vascularized autografts for discontinuity defects (DD), mandibular interpositional grafting (MI), and socket preservation (SP). All identified articles were evaluated and screened by 2 independent reviewers to meet strict inclusion criteria. Articles meeting the inclusion criteria were further evaluated for data extraction. The initial search identified a total of 526 articles from the electronic database and manual search. Of these, 335 articles met the inclusion criteria after a review of the titles and abstracts. From the 335 articles, further review of the full text of the articles produced 90 articles that provided sufficient data for extraction and analysis.

RESULTS:

For the maxillary sinus grafting (SG) technique, the results showed a total of 5,128 implants placed, with follow-up times ranging from 12 to 102 months. Implant survival was 92% for implants placed into autogenous and autogenous/composite grafts, 93.3% for implants placed into allogeneic/nonautogenous composite grafts, 81% for implants placed into alloplast and alloplast/xenograft materials, and 95.6% for implants placed into xenograft materials alone. For alveolar ridge augmentation, a total of 2,620 implants were placed, with follow-up ranging from 5 to 74 months. The implant survival rate was 95.5% for GBR, 90.4% for OVG, 94.7% for DO, and 83.8% for COG. Other techniques, such as DD, RS, SP, and MI, were difficult to analyze because of the small sample size and data heterogeneity within and across studies.

CONCLUSIONS:

The maxillary sinus augmentation procedure has been well documented, and the long-term clinical success/survival (> 5 years) of implants placed, regardless of graft material(s) used, compares favorably to implants placed conventionally, with no grafting procedure, as reported in other systematic reviews. Alveolar ridge augmentation techniques do not have detailed documentation or long-term follow-up studies, with the exception of GBR. However, studies that met the inclusion criteria seemed to be comparable and yielded favorable results in supporting dental implants. The alveolar ridge augmentation procedures may be more technique- and operator-experience-sensitive, and implant survival may be a function of residual bone supporting the dental implant rather than grafted bone. More in-depth, long-term, multicenter studies are required to provide further insight into augmentation procedures to support dental implant survival.

Evaluation of three-dimensional changes after sinus floor augmentation with different grafting materials.


Abstract

OBJECTIVE:

The aim of this retrospective investigation was to assess the dimensional stability of different grafting materials after maxillary sinus floor augmentation with computed tomography (CT) scans.

MATERIALS AND METHODS:

Two postoperative CT scans were available from 16 patients who had undergone maxillary sinus lift procedures. The first scan was made within a few days after the surgical intervention and the second one >6 months later. A total of 25 maxillary sinuses were augmented with different materials before implant insertion by lateral antrostomy in a staged approach. The volume of bone formation was calculated using the Somaris Sienet Magic View software.

RESULTS:

Based on volumetric measurements of the augmented domes derived from the image sections, shrinkage was about 26%. The mean of the augmented bone volume was 3.02 cm³ (1.4-5.56 cm³; SD+/-1.18 cm³) as determined in the first CT scan. The respective mean volume in the second CT scan amounted to 2.28 cm³ (0.92-4.46 cm³; SD+/-1.07 cm³).

CONCLUSION:

Within the limits of our descriptive and analytic study, the results indicate a significant reduction of the graft volume after maxillary sinus augmentation. Further prospective studies will have to evaluate the quantitative changes of different bone graft materials for maxillary sinus augmentation procedures in order to improve long-term implant stability.

Augmentation procedures for the rehabilitation of deficient edentulous ridges with oral implants.

Chiapasco M, Zaniboni M, Boisco M.


Abstract

OBJECTIVES:

To analyze publications related to augmentation procedures and to evaluate the success of different surgical techniques for ridge reconstruction and the survival/success rates of implants placed in the augmented areas.

MATERIAL AND METHODS:

Clinical investigations published in English involving at least 5 patients and with a minimum follow-up of 6 months were included. The following procedures were considered: a) Guided bone regeneration (GBR); 2) Onlay bone grafts; 3) Inlay grafts; 4) Bone splitting for ridge
expansion (RE); 5) Distraction osteogenesis (DO); and 6) Revascularized flaps. Success rates of augmentation procedures and related morbidity, as well as survival and success rates of implants placed in the augmented sites were analyzed.

RESULTS:

Success rates of surgical procedures ranged from 60% to 100% for GBR, from 92% to 100% for onlay bone grafts, from 98% to 100% for ridge expansion techniques, from 96.7% to 100% for DO, and was 87.5% for revascularized flaps, whereas survival rates of implants ranged from 92% to 100% for GBR, from 60% to 100% for onlay bone grafts, from 91% to 97.3% for RE, from 90.4% to 100% for DO, and, finally, was 88.2% for revascularized flaps.

CONCLUSION:

On the basis of available data it was shown that it was difficult to demonstrate that a particular surgical procedure offered better outcome as compared to another. The main limit encountered in this review has been the overall poor methodological quality of the published articles. Therefore larger well-designed long term trials are needed.

A clinical long-term radiographic evaluation of graft height changes after maxillary sinus floor augmentation with a 2:1 autogenous bone/xenograft mixture and simultaneous placement of dental implants.

Hatano N, Shimizu Y, Ooya K.

Abstract

The aim of the present study was to assess long-term changes in sinus-graft height after maxillary sinus floor augmentation and simultaneous placement of implants. A total of 191 patients who underwent maxillary sinus floor augmentation were radiographically followed for up to about 10 years. A 2 : 1 mixture of autogenous bone and bovine xenograft (Bio-Oss) was used as the graft material. Sinus-graft height was measured using 294 panoramic images immediately after augmentation and up to 108 months subsequently. Changes in sinus-graft height were calculated with respect to implant length and original sinus height. Patients were divided into three groups based on the height of the grafted sinus floor relative to the implant apex: Group I, in which the grafted sinus floor was above the implant apex; Group II, in which the implant apex was level with the grafted sinus floor; and Group III, in which the grafted sinus floor was below the implant apex. After augmentation, the grafted sinus floor was consistently located above the implant apex. After 2-3 years, the grafted sinus floor was level with or slightly below the implant apex. This relationship was maintained over the long term. Sinus-graft height decreased significantly and approached original sinus height. The proportion of patients classified as belonging to Group III reached a maximum from year 3 onwards. The clinical survival rate of implants was 94.2%. All implant losses occurred within 3 years after augmentation. We conclude that progressive sinus pneumatization occurs after augmentation with a 2 : 1 autogenous bone/xenograft mixture, and long-term stability of sinus-graft height represents an important factor for implant success.
Long-term changes in graft height after maxillary sinus floor elevation with different grafting materials: radiographic evaluation with a minimum follow-up of 4.5 years.

Zijderveld SA, Schulten EA, Aartman IH, ten Bruggenkate CM.


Abstract

OBJECTIVE:

To compare the vertical dimensional changes with regard to graft height in a long-term follow-up in patients treated with two different grafting materials used in maxillary sinus floor elevation procedures.

MATERIAL AND METHODS:

Twenty consecutive patients were included. One group was grafted with autogenous bone from the mandible (chin area), and the other group was augmented with a 100% beta-tricalcium phosphate (beta-TCP). During a 4- to 5-year period, in each patient, at least five panoramic radiographs were made. These panoramic radiographs were used for morphometric measurements, at three different locations. The three locations were the first bone to implant contact at the distal side of the second most posterior implant (L1), halfway between this implant and the most posterior implant (L2) and the site 5 mm distal to the most posterior implant (L3). The measured vertical bone heights were evaluated to assess whether there was loss of height and, if so, whether the reduction in graft height occurred in an initial healing period or whether it was an ongoing process during the whole study period.

RESULTS:

There is a statistically significant reduction of vertical bone height in time at all locations (P<0.001). The mean decrease of the total vertical height during the whole study period at the three different locations did not differ significantly for and between both grafting groups. Repeated measures analysis of variance showed that at location L1, the reduction in millimeters per month decreased in time (P=0.001). There was no difference between the grafting groups (P=0.958). Similar results were found on L2 (P=0.005). For L3, there also appeared to be a statistically significant difference in reduction in time in millimeters per month (P=0.004). There was no statistically significant difference in height reduction between locations L1, L2 and L3 for vertical bone height and graft height, respectively.

CONCLUSIONS:

Both beta-TCP and mandibular bone grafts resulted in radiographic reduction of the vertical height over the 5-year period following maxillary sinus floor elevation. After an initial height reduction in the first 1.5 year, subsequent changes were minimal. No significant differences were observed between the two types of grafting material. There was no statistically significant difference in reduction between the three locations for vertical bone height and graft height, respectively.
Histological and histomorphometrical analyses of biopsies harvested 11 years after maxillary sinus floor augmentation with deproteinized bovine and autogenous bone.

Mordenfeld A, Hallman M, Johansson CB, Albrektsson T.


Abstract

OBJECTIVE:
The purpose of the present study was to histologically and histomorphometrically evaluate the long-term tissue response to deproteinized bovine bone (DPBB) particles used in association with autogenous bone and to compare particle size after 6 months and 11 years, in the same patients, in order to determine possible resorption.

MATERIAL AND METHODS:
Twenty consecutive patients (14 women and six men) with a mean age of 62 years (range 48-69 years) with severe atrophy of the posterior maxilla were included in this study. Thirty maxillary sinuses with <5 mm subantral alveolar bone were augmented with a mixture of 80% DPBB and 20% autogenous bone. Eleven years (mean 11.5 years) after augmentation, biopsies were taken from the grafted areas of the 11 patients who volunteered to participate in this new surgical intervention. The following histomorphometrical measurements were performed in these specimens: total bone area in percentage, total area of the DPBB, total area of marrow space, the degree of DPBB-bone contact (percentage of the total surface length for each particle), the length of all DPBB particles and the area of all DPBB particles. The length and the area of the particles were compared with samples harvested from the same patients at 6 months (nine samples) and pristine particles from the manufacturer.

RESULTS:
The biopsies consisted of 44.7+/-16.9% lamellar bone, 38+/-16.9% marrow space and 17.3+/-13.2% DPBB. The degree of DPBB to bone contact was 61.5+/-34%. There were no statistically significant differences between the length and area of the particles after 11 years compared with those measured after 6 months in the same patients or to pristine particles from the manufacturer.

CONCLUSION:
DPBB particles were found to be well integrated in lamellar bone, after sinus floor augmentation in humans, showing no significant changes in particle size after 11 years.
A meta-analysis of histomorphometric results and graft healing time of various biomaterials compared to autologous bone used as sinus floor augmentation material in humans.

Klijn RJ, Meijer GJ, Bronkhorst EM, Jansen JA.


Abstract

BACKGROUND:

To date, no studies have been published in which histomorphometric data from a large group of patients comparing various biomaterials for sinus floor augmentation procedures were evaluated.

MATERIALS AND METHODS:

A meta-analysis of the English literature from January 1993 till April 2009 was carried out. Out of 147 titles, according to our criteria, 64 articles were selected for analysis describing the use of autologous bone and their alternatives, such as allogenic, xenogenic, and alloplastic materials.

RESULTS:

On the basis of autologous bone grafting, a reference value for total bone volume (TBV) of 63% was found. Particulation of the bone graft resulted in a general reduction of −18% in TBV. Delayed implant placement reduced the TBV with −7%. Overall TBV was 8% or 6% higher if a biopsy was, respectively, taken before 4.5 months or after 9.0 months after initial sinus augmentation surgery. Allogenic, xenogenic, alloplastic, or combinations of graft materials all resulted in a significant lower amount of TBV compared to autologous bone grafting ranging from −7% to −26%. Inventorying the effect of "biopsy time" for autologous bone, the TBV was significantly higher before 4.5 and after 9.0 months of healing time compared to period in between. Surprisingly, no significant differences in TBV with respect to "biopsy time" for bone substitutes were found.

CONCLUSIONS:

On the basis of the aspect of TBV autologous bone still has to be considered to be the gold standard in sinus augmentation surgery. However, the consequence of the TBV for implant survival is still unraveled yet.
A literature review on biomaterials in sinus augmentation procedures.

Browaeys H, Bouvry P, De Bruyn H.


Abstract

BACKGROUND:

Sinus augmentation is a common procedure to increase bone volume and allow for proper implant placement in the atrophic posterior maxilla. Although the patient's own bone is considered the best grafting material, various synthetic or bovine-derived alternatives are used to simplify the grafting procedure.

PURPOSE:

The overall objective of this review was to assess the efficacy of different graft materials used in sinus augmentation procedures as demonstrated in animal studies.

MATERIALS AND METHODS:

A specific and sensitive database was initially created via PUBMED, focusing on studies published in English peer-reviewed journals between 1995 and 2004 and kept updated until 2006.

RESULTS:

Twenty-six articles were available for comparison and discussion; none concerned the use of alloplastic materials; 24 were comparative histomorphometric; and two were biomechanical studies. Because of a great variability in study designs, different implant types, great range in follow-up, and lack of specific integration or loading period, a comparison of the studies and the biomaterials used was difficult.

CONCLUSIONS:

In general, autogenous bone is the most predictable material of choice for augmentation procedures, despite a 40% resorption, because it is highly osteoconductive and less dependent on sinus floor endosteal bone migration. The addition of bovine bone mineral to autogenous bone can be beneficial for graft success because it acts as a slowly resorbing space maintainer. Porous hydroxyapatite is suitable when mixed with autogenous bone because it enhances bone formation and bone-to-implant contact in augmented sinuses. Histological evaluation showed that demineralized freeze-dried bone is inferior to other materials. Within the limitation of the animal studies examined in this review and only based on histological examination, the initial osseointegration of implants seems independent of the biomaterial used in grafting procedures.
Systematic review of survival rates for implants placed in the grafted maxillary sinus.

Del Fabbro M, Testori T, Francetti L, Weinstein R.


Abstract

Based on a systematic review of the literature from 1986 to 2002, this study sought to determine the survival rate of root-form dental implants placed in the grafted maxillary sinus. Secondary goals were to determine the effects of graft material, implant surface characteristics, and simultaneous versus delayed placement on survival rate. A search of the main electronic databases was performed in addition to a hand search of the most relevant journals. All relevant articles were screened according to specific inclusion criteria. Selected papers were reviewed for data extraction. The search yielded 252 articles applicable to sinus grafts associated with implant treatment. Of these, 39 met the inclusion criteria for qualitative data analysis. Only 3 of the articles were randomized controlled trials. The overall implant survival rate for the 39 included studies was 91.49%. The database included 6,913 implants placed in 2,046 subjects with loaded follow-up time ranging from 12 to 75 months. Implant survival was 87.70% with grafts of 100% autogenous bone, 94.88% when combining autogenous bone with various bone substitutes, and 95.98% with bone grafts consisting of bone substitutes alone. The survival rate for implants having smooth and rough surfaces was 85.64% and 95.98%, respectively. Simultaneous and delayed procedures displayed similar survival rates of 92.17% and 92.93%, respectively. When implants are placed in grafted maxillary sinuses, the performance of rough implants is superior to that of smooth implants. Bone-substitute materials are as effective as autogenous bone when used alone or in combination with autogenous bone. Studies using a split-mouth design with one variable are needed to further validate the findings.