

The Reconstruction Purposes Implant Deficits Bone Ridge Edentulous

¹Antonio Crispino, ²Leonzio Fortunato

ABSTRACT

The objective of this review was to analyze the studies in the literature, concerning the procedures to increase bone volume in order implant and to evaluate (A) the results of different surgical approaches for the reconstruction of alveolar bone deficits and (B) the percentages of survival/success of implants placed in homes rebuilt with different techniques.

The present revision is based on original articles including both randomized clinical trials both clinical studies that include more than 10 patients treated and followed for a minimum period of 12 months.

We analyzed the success rates of the various techniques, success rates and/or survival of implants placed in areas with increased bone volume.

Keywords: Bone manipulation, Implant, Osteotome, Sinus floor elevation.

How to cite this article: Crispino A, Fortunato L. The Reconstruction Purposes Implant Deficits Bone Ridge Edentulous. *Int J Clin Implant Dent* 2015;1(2):66-71.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Implant therapy has proven its worth in recent decades in the rehabilitation of patients partially or fully edentulous (Albrektson et al 1986; van Steenberghe et al 1990; Lekholm et al 1992; Leonhardt et al 2002). On the other hand, the presence of bone deficits of saddles edentulous due to atrophy, trauma or periodontal disease has often been a limitation in the possibility of inserting the implant.¹ In order to correct such defects of bone volume have been proposed in the literature different methods:

- Grafts of various materials that function as osteoconductive matrix for the neo-bone formation (Burchardt 1983)
- Guided bone regeneration (GBR) in which mechanical barriers represented by membranes maintain a space for the transformation of the clot in bone (Nyman et al 1981; Nyman and Lang 1994)

- Sagittal osteotomy with expansion of the alveolar ridge to create a space between two cortical occupied by clot that evolve into bone (Engelcke et al 1997)¹¹
- Distraction osteogenesis in which two bone segments, fractured surgically, are mechanically separated
- Osteoinduction through the use of appropriate growth factors (Urist 1965; Reddi et al 1987).

Given that the use of growth factors with potential osteoinductive, such as bone morphogenetic proteins (BMPs) are still in the experimental stage, the most used methods for increasing bone volume in deficit edentulous saddles which affect an adequate implant insertion are currently represented by guided bone regeneration, such as bone grafts 'onlay' or 'inlay', from crestal expansion and distraction osteogenesis.⁸ Although they are present in the literature a large number of studies regarding the use of various techniques and materials used for the reconstruction bone, implant purposes, saddles atrophic edentulous, there are still controversial opinions on what may be the criteria for the choice of the method more reliable and predictable. This is often due to the fact that many of the publications in the literature are lacking from a methodological point of view (inadequacy in the sample and in the criteria for inclusion/exclusion in the study, the absence of randomization, inadequate in the definition of success/failure, insufficient period observation post-treatment). The objective of this review was to analyze the studies in the literature, concerning the procedures to increase bone volume in order implant and to evaluate (A) the results of different surgical approaches for the reconstruction of alveolar bone deficits and (B) the percentages of survival/success of implants placed in homes rebuilt with different techniques.

MATERIALS AND METHODS

Type of Revision/Study Selection

The present revision is based on original articles including both randomized clinical trials both clinical studies that include more than 10 patients treated and followed for a minimum period of 12 months. The method of computerized search was based on 'keywords' of articles published in international journals from 1966 to 2014 through Medline. These articles were reviewed and analyzed by the first author of this review.

¹Professor, ²Professor and Head

^{1,2}Department of School of Dentistry, University of Catanzaro, CZ Italy

Corresponding Author: Antonio Crispino, Professor, Department of School of Dentistry, University of Catanzaro, CZ, Italy, Phone: 0039 0961759798, e-mail: crispino@unicz.it

Evaluation of Results

We analyzed the success rates of the various techniques, success rates and/or survival of implants placed in areas with increased bone volume.

GUIDED BONE REGENERATION (GBR)

Patients and Methods

Included in the analysis only studies on volume increases bone prior to implant placement. The number of patients treated for bone defects of the vertical type or horizontal with resorbable membranes is not bio-degradable amounted to a total of 1097.¹² Among these, only 70 patients were treated for pure bone defects of the vertical and they were included in the total 2002 plants of which 1057 simultaneously in GBR and the remainder in a second subsequent stage surgery. On the above mentioned facilities were built prosthesis is removable and fixed after an average period of 6 months from the insertion implant. The average time of observation by functionalization prosthetic ranged from 6 to 133 months.⁴

Results

Only eight of the 17 studies analyzed report the pure success rates in the correction of bone defects using GBR while others report only the percentages of implant survival (67–96%). The amount of bone defects in the reconstructed vertical ranged from 2 to 7 mm, while for the horizontal defects ranged from 2 to 4 mm and were not reported statistically significant differences between the results obtained with resorbable and non-resorbable membranes.⁷ The percentages of implant survival in increased bone ranged from 67.8 to 90% even in this case no significant differences between the two types of membranes. The implant survival in locations with horizontal deficits ranged from 78 to 100% and in locations with vertical deficit from 99 to 100%.² The failures of the technique GBR were primarily related to exposure/contamination and infection of the membranes resulting in partial loss or Total tissue regenerated. The stability of the bone volume increased was clinically documented radiographically. In the sites treated with GBR vertical, in an observation period of 1 to 7 years, is shown a loss of 1 to 2.9 mm of peri-implant bone in sites treated with GBR horizontal 40% of newly formed bone was lost. It is also clearly confirmed in experimental studies on animals (Rasmusson et al 1999).

Conclusion

The data seem to show that the GBR technique may have a certain percentage of success in the treatment of bone defects vertical and horizontal need to implant. The

survival rates of the inserted implants in edentulous saddles increased with this method are similar to those relating to implants inserted in locations not requiring interventions to increase bone volume. As regards the material of choice for the GBR technique are not reported differences between non-absorbable and absorbable materials and also the type of graft material (autologous, heterologous or synthetic).

From the results of the studies analyzed in this revision can be deduced that the absolute need to use this method to get yourself a cover peri-implant bone defects in the case of limited vertical/horizontal is still questionable.

In fact, in two studies with adequate controls, present in the review (Mayfield et al 1998; Zitzmann et al 2001) has been shown to the same percentage of success/implant survival, if any primary stability of the fixtures, for implants placed in bone deficits regenerated with GBR and unregenerate.

In light of this it may be inferred that, in the presence of an adequate amount of bone, a modest deficit of the alveolar ridge or a dehiscence cortical not necessarily lead to a failure or to a reduced function implant.¹⁰

So, the question that should find a scientific answer is related to how much exposed implant surface should be the limit between obtaining or less osseointegration.

NONAUTOLOGOUS BONE GRAFTS TO 'ONLAY'

Patients and Methods

The research included only one study (Block and Degen 2004). In 11 patients with defects in the horizontal mandibular authors have used bone grafts particulates lyophilized (DFBA) with positioning sub-periosteum. After 4 months of healing, the treated sites were included 35 plants. The observation period by functionalization prosthetic is continued for 12 months.

Results

The authors report an increase in bone volume from 5 to 8 mm that when placing the implant had been resorbed up to 50%. The percentage of implant survival at 12 months was reported to be 97%.

Conclusion

The scarcity of data on the use of these materials for implants type 'onlay' impossible to draw any appropriate conclusion.

AUTOLOGOUS BONE GRAFTS TO 'ONLAY'

Patients and Methods

We included 29 studies in this revision. In these studies, 875 patients were treated with varying degrees of alveolar

atrophy that did not allow a correct implant insertion. The number of defects treated with autologous bone grafts to onlay taken from locations both intraoral and extraoral amounted to 791 of which 198 593 in the mandible and the maxilla.

The donor sites were 147 grafts for intraoral (symphysis, body/mandibular branch), for the remaining 644 extraoral (600 from iliac crest, 44 from calvaria) and most of the bone grafts were in the form in 'block'.³

The authors included a total of 4445 plants of which 415 in the reconstructed mandible, maxilla in 2547, while for 1483 the plant was not specified here. The implant insertion was contextual reconstructive surgery in 60% of cases and in the remaining 40% after 4 to 6 months of healing. The functionalization prosthetic occurred after a period of 5 to 6 months after insertion.

Results

The authors report only cure rates of grafts that relate occur in 90 to 100% of patients. The implant survival was 82% in the maxilla and 94% in the mandible. The majority of implant failures occurred on grafts taken from the iliac crest (17.5%) while it was 5.1% of grafts taken from the calvaria and 2.9% of those taken from intraoral locations. The implant survival was lower (79% maxillary—94% mandibular) implants placed contextually grafting compared to those inserted after a period of recovery (94% maxillary—100% mandibular). Note, however, that only 12 of the 29 articles analyzed SPECIFIED precisely the definition of survival/implant success.

Conclusion

This revision seems to show that the use of autologous grafts to 'onlay' for reconstruction of defects/atrophy of the jaw implant in order to be considered an acceptable therapeutic method. Scarce, if not absent, are the information related to the degree of real increase in volume obtained after the use of various types of grafting and the degree of resorption postsurgery depending on the type of defects treated. Only a few studies report the percentages of bone resorption of the graft (for Review EAO—Consensus 2006); defects in vertical from 1 to 5 years after implant loading resorption of withdrawals from the iliac crest ranged from 12 to 60% of the initial height of the graft against 1 to 15% of reabsorption of withdrawals from the calvaria.

The same data are absent for what regards withdrawals from intraoral locations. As for the defects of the horizontal type only three studies (Chiapasco et al 1999; Raghoobar et al 2000; Jemt and Lekholm 2003) report precise data on the degree of resorption of the graft after a year that varies from 10 to 50% the original height of the graft. In conclusion, from the data we can deduce that:

- Survival/success cumulative installations shows a progressive decrease from the 1st to the 5th year after prosthetic functionalization
- The implants inserted in the maxillary bone reconstructions had survival rates lower than those of the mandible
- The grafts taken from the iliac crest faced a greater resorption compared with grafts taken from the calvaria and intraorally (branch/body of the mandible).

BONE GRAFTS TO 'INLAY'

Bone grafts to 'inlay' have been proposed for the correction of defects that both mandibular jaw. Differences related to the different surgical techniques and other aspects of clinical lead us to deal separately with the grafts to 'inlay' mandibular and maxillary.

BONE GRAFTS TO 'INLAY' MANDIBULAR

Patients and Methods

The research included two studies (Satow et al 1997; Stellingsma et al 2004). In 50 patients with severe atrophy mandibular osteotomy was performed with interforaminal horizontal insertion interpositional bone grafts to 'inlay' taken from the iliac crest.⁹ After a healing period of 3 to 5 months were included in the areas reconstructed 153 plants which after further healing period were functionalized prosthetic and observed for 12 to 84 months.

Results

The authors reported an overall success rate of 98%. To implant insertion was observed a limited reduction of the increase bone initial (10–15%). The implant survival during the observation period proved to be 90 to 95%.

Conclusion

This review, despite the limited sample of patients and related systems, demonstrates the validity of the technique of inlay grafts to interpositional in the treatment of anterior mandibular atrophy. However, in a randomized controlled clinical trial (Stellingsma et al 2004) where the survival rate of implants placed in mandibular areas increased with this method was compared with that of plants 'short' placed in locations not increased, the implant survival in homes rebuilt was significantly lower than that of installations 'short' in areas not reconstructed. The authors concluded that patients with severe mandibular atrophy can be treated more predicibilmente with installations of reduced length, without the need for grafting procedures.



BONE GRAFTS TO 'INLAY' JAWS

The bone grafts to 'inlays' for correction of bone defects in the jaw are represented by three different procedures that will be dealt with separately:

- Grafts to 'Inlay' with sinus nasal
- Grafts to 'Inlay' with Le Fort I osteotomy
- Grafts to 'Inlay' with sinus lift.

Results

For 588 systems installed in homes treated with grafts and approach transalveolar authors report a survival of 96 and 94% for 8781 implants placed in grafts with lateral approach.⁶ For both approaches the survival of implants inserted at the same time reconstructive procedure turned out to be lower on average by 5 to 10% compared to that of the implants inserted in a second surgical procedure. As regards the different types of bone graft materials used, from the data available, there were significant differences in the percentages of implant survival.

Conclusion

This revision seems to demonstrate the validity of the procedure of sinus lift with both transalveolar lateral approach in allowing the insertion of implants in the posterior maxilla bone atrophy.⁵ The implant survival rate is similar to that of implants placed in bone 'native'. The material of choice for the grafts did not demonstrate significant in influencing the results, while a certain significance is represented by the choice whether simultaneous or deferred implant insertion. In a few studies, the choice of implant was clearly related to the residual quantity/quality of crestal bone residue and then the degree of primary stability of implants placed simultaneously obtained by the intervention of sinus lift. The same considerations can be applied to the time of prosthetic functionalization, as though in no study installations prove functionalized immediately after insertion, the wait interval preload of 2 to 13 months should once again be related to the degree of primary stability, the length and type of implant surface used.¹⁵

INTERVENTIONS SEPARATION/EXPANSION OF THE RIDGE

Patients and Methods

Research has selected the 27 studies present as complete articles, three studies (Engelcke et al 1997; Bruschi et al 1998; Chiapasco et al 2006). A total of 392 patients with edentulous thin and narrow saddles were subjected to the expansion technique and simultaneous positioning of 733 plants. During the surgical separation gap created was

left patulous or filled with different types of materials such as:—collagen sponges,—autologous bone,—heterologous bone,—hydroxyapatite. After a healing period of 3 to 6 months the implants were prosthesised. Patients were observed from 6 to 68 months from the prosthetic functionalization.

Results

The success rate of the surgical technique was reported in the 98 to 100% while the percentage of implant survival ranged from 91 to 97%.

Conclusion

This revision seems to have a predictability of this minimally invasive method in correcting edentulous saddles of insufficient amplitude. The implant survival reported is comparable to that of the implants inserted in the bone is not reconstructed. To underline the fact that this method is limited in its application to the edentulous saddles where between the buccal and palatal/lingual is present a distinct quantity of bone marrow and for this reason in the studies presented the highest percentage of defects treated was charged to the maxillary higher than mandibular defects consist of cortical more compact with poor marrow interposed.

INTERVENTIONS OF DISTRACTION OSTEOGENESIS

Patients and Methods

The literature review allowed the selection of five studies, the 32 present, in which 123 patients with bone deficits of vertical against edentulous saddles were treated with equipment distractive both types Intraoral-intraosseous and intraoral-extraosseous. The degree of distraction applied through the equipment ranged from 0.5 to 1 mm per day and were included a total of 327 plants, 62 of which in addition to the function of prosthetic abutments served as equipment intraoral-intraosseous for the distraction, while the remaining 265 plants were inserted 2 to 3 months after the increase in bone volume.¹⁴ The prosthetic rehabilitation was started after 3 to 6 months from insertion implant. The patients were observed for a period that ranged from 6 to 60 months after the operation.

Results

The success rate of the surgical technique was 98%, the gain vertical bone ranged from 3 to 13 mm, while the implant survival was reported to be 97%. Three percent of implant failure was associated facilities used as distractive intraosseous devices.

Conclusion

Despite the limited number of patients and implants inserted this revision seems to show that this method is a therapeutic option used when you cannot/want to resort to the use of bone grafts. Its application looks more suitable for mandibular defects rather than the maxilla where the inextensibility of fibropalate makes it difficult to maintain an adequate carrier of distractive forces. The survival rates of bone implant increased with this technique are similar to those of implants inserted into bone 'native'.

GENERAL CONCLUSION

The present revision has shown that the correction of bone deficits of saddles edentulous can be obtained with the use of different surgical methods, however, on the basis of the data reported it is difficult if not impossible to prove that a method is better than another in terms of predictability in the obtaining of volume increase in the percentage of bone or implant survival. Undoubtedly one of the most accurate in the construction of clinical research protocols, which meets the criteria of the consolidated standards of reporting trials (CONSORT) (Moher et al 2001), would have allowed a better understanding of when and under what circumstances it is really essential to approach increases of bone volume and which can be the most appropriate techniques given a precise indication. Generically, once highlighted the absolute need to resort to surgery to increase bone volume, priority in the choice of surgical technique should be given to the method:

- More predictable in obtaining the required result
- More simple execution
- Of less invasive and less risk of complications
- That it can reach the same result in the shortest period of time.

In any case, in this review, despite the limitations mentioned above, one can draw the following conclusions:

The regenerative techniques GBR can correct vertical bone deficit, but complications can often lead to failure.

The bone grafts are valid in the increased bone volume, but the use of 'major' withdrawals to onlays can not be justified in increasing bone vertically extensive resorption of the mandibular.⁹ In the case of inlay grafts to some substitutes bone, used especially for the rises of the maxillary sinus, have shown to have similar effect to grafting with autologous bone.¹³

Osteotomy with sagittal ridge expansion is indicated by increases in the buccal-lingual/palatal and is most often applied to anatomical limitations, in the maxilla.

Distraction osteogenesis can correct vertical bone deficit, while increases horizontal (buccal-lingual/palatal) saddles edentulous thin is a limited application.

Similar findings were reported by Esposito et al (2006) in a review of nine randomized trials of techniques to increase bone volume emphasized the need for additional and more appropriate clinical studies, since the information available in the literature it was not possible to draw that generic indications about indications, on the criteria for choice of the various reconstruction techniques and their respective success rates both post-intervention both implant survival in the long term.

REFERENCES

1. Aghaloo TL, Moy PK. Which hard tissue augmentation techniques are the most successful in furnishing bony support for implant placement? Erratum. *Int J Oral Maxillofac Implants* 2008;23:56.
2. Chiapasco M, Zaniboni M, Boisco M. Augmentation procedures for the rehabilitation of deficient edentulous ridges with oral implants. *Clin Oral Implants Res* 2006;17(Suppl 2):136-159.
3. Fiorellini JP, Nevins ML. Localized ridge augmentation/preservation. A systematic review. *Ann Periodontol* 2003;8:321-327.
4. Simion M. Horizontal and vertical bone volume augmentation of implant sites using guided bone regeneration (GBR). In: Lang NP, editor. *Proceedings of the 3rd European Workshop on Periodontology*, February 1999, Ittingen, Switzerland, 1999; pp. 500-519. Berlin: Quintessence.
5. Pjetursson BE, Tan WC, Zwahlen M, Lang NP. A systematic review of the success of sinus floor elevation and survival of implants inserted in combination with sinus floor elevation Part I—lateral approach. *J Clin Periodontol* 2008;35: 243-267.
6. Jensen OT, Shulman LB, Block MS, Iacono VJ. Report of the sinus consensus conference of 1996. *Int J Oral Maxillofac Implants* 1998;(Suppl.):11-45.
7. Hammerle CHF, Jung RE, Feloutzis A. A systematic review of survival of implants in bone sites augmented with barrier membranes (guided bone regeneration) in partially edentulous patients. *J Clin Periodontol* 2002;29(Suppl 3): 226-231.
8. Jung RE, Thoma DS, Hammerle CHF. Assessment of the potential of growth factors for localized alveolar ridge augmentation: a systematic review. *J Clin Periodontol* 2008;35:203-229.
9. Rocchietta I, Fontana F, Simion M. Clinical outcomes of vertical bone augmentation to enable dental implant placement: a systematic review. *J Clin Periodontol* 2008;35: 230-242.
10. Rammelsberg P, Schmitter M, Gabbert O, Bermejo LJ, Eiffler C, Schwarz S. Influence of bone augmentation procedures on the short-term prognosis of simultaneously placed implants. *Clin Oral Implants Res* 2012 Oct;23(10):1232-1237.
11. Donos N, Mardas N, Chadha V. Clinical outcomes of implants following lateral bone augmentation: systematic assessment of available options (barrier membranes, bone grafts, split osteotomy). *J Clin Periodontol* 2008;35:173-202.
12. Hammerle CHF. Membranes and bone substitutes in guided bone regeneration proceedings of the Third European



- Workshop on Periodontology, February 1999, Ittingen, Switzerland, 1990. pp. 468-499. Berlin:Quintessence.
13. Tan WC, Lang NP, Zwahlen M, Pjetursson BE. A systematic review of the success of sinus floor elevation and survival of implants inserted in combination with sinus floor elevation Part II—Transalveolar technique. *J Clin Periodontol* 2008;35:268-281.
 14. Wallace SS, Froum SJ. Effect of maxillary sinus augmentation on the survival of endosseous dental implants. A systematic review. *Ann Periodontol* 2003;8:328-343.
 15. Bruggenkate TCM. Sinus floor elevation and its predictability. In: Lang NP, editor. *Proceedings of the Third European Workshop on Periodontology, February 1999, Ittingen, Switzerland, 1999.* p. 535-543. Berlin: Quintessence.