Consensus of the Amapá society of implantodontics on the criteria for choosing a bone graft.

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ORIGINAL ARTICLE

ABSTRACT

A bone graft may be used in a variety of clinically practiced implant surgeries, namely, guided bone regeneration, extraction socket preservation or reconstruction, ridge augmentation, and sinus membrane elevation. The bone graft is of various types depending on the material, for instance, autogenous bone graft, allograft, xenograft, alloplastic graft, and autogenous bone graft with demineralized dentin matrix, which may be used alone or with other materials. Bioactive agents that promote bone formation, such as recombinant human bone morphogenetic protein-2 (rhBMP-2), have been shown to exhibit a clinically beneficial effect on bone regeneration. Here, we intend to present surgical guidelines for bone grafts and criteria for selection of bone graft materials by referring to evidence-based studies and recent lectures on the subject of ‘bone grafts for implant dentistry’ at the Amapá society of implantodontics, 2020.

Keywords: Bone graft, Dental Implant, Consensus, Amapá society of implantodontics;
Consenso da sociedade Amapaense de implantodontia sobre os critérios de escolha do enxerto ósseo.

RESUMO

Um enxerto ósseo pode ser usado em uma variedade de cirurgias de implante praticadas clinicamente, a saber, regeneração óssea guiada, preservação ou reconstrução do alvéolo de extração, aumento da crista e elevação da membrana sinusal. O enxerto ósseo é de vários tipos dependendo do material, por exemplo, enxerto ósseo autógeno, aloenxerto, xenoenxerto, enxerto aloplástico e enxerto ósseo autógeno com matriz dentinária desmineralizada, que podem ser utilizados isoladamente ou com outros materiais. Os agentes bioativos que promovem a formação óssea, como a proteína-2 morfogenética óssea humana recombinante (rhBMP-2), mostraram exibir um efeito clinicamente benéfico na regeneração óssea. Aqui, pretendemos apresentar diretrizes cirúrgicas para enxertos ósseos e critérios para seleção de materiais de enxerto ósseo, referindo-nos a estudos baseados em evidências e palestras recentes sobre o tema ‘enxertos ósseos para implantodontia’ na sociedade de implantodontia do Amapá, 2020.

Palavras-chaves: Enxerto ósseo, Implante Dentário, Consenso, Sociedade Amapaense de Implantodontia.
INTRODUCTION

Implant surgery without any bone graft results in better prognosis than the surgery with bone graft. In principle, minimally invasive surgery should be conducted, and the research community continues to develop it. Stability of the short-length implant in the mandible has already been confirmed. It has also been reported that the stability of the long-length implant in the maxilla with sinus bone graft is not significantly different from that of the short-length implant in the maxilla (1). On the other hand, studies have shown that implants do not show significant difference between the sinus elevation with bone graft and without bone graft. However, proper bone formation is achieved when maxillary sinus elevation is performed without a bone graft. It is safe to perform the sinus elevation without the bone graft in the presence of minimal alveolar bone which leads to initial implant stabilization. This technique should be performed without perforating the sinus membrane (2,3).

On the other hand, the situations requiring bone grafting can be summarized as follows. (1) If the residual bone mass is absolutely insufficient, (2) For the purpose of preventing the resorption of the labial alveolar bone in the anterior portion requiring esthetics or increasing the bone thickness, (3) Since the loss of bone wall is significant after extraction, it is important to create a favorable environment for secondary implant placement, (4) To preserve bone resorption in the extraction socket. The bone graft can be of various types depending on the material, namely, autograft, allograft, xenograft, alloplastic material graft, and autogenous demineralized dentin matrix. In recent years, bioactive bone regenerative agents, such as recombinant human bone morphogenetic protein-2 (rhBMP-2) have been used in many clinical cases to promote bone formation (4-7). Clinicians are most interested in selecting the correct kind of bone graft material in the cases where the bone graft is needed, however, no such clear criteria are described in the literature. Therefore, we summarize the criteria for selection of bone graft materials by referring to the academic papers and famous Korean clinician’s lectures by The Korean Academy of Implant Dentistry.

SELECTION OF BONE GRAFT MATERIALS ON THE BASIS OF ENVIRONMENT

Bone grafts are often required during an implant surgery. Their material must be selected depending on the surgical conditions. The following is the summary of the evidence-based theory or the consensus of clinicians with respect to bone-graft selection:

1. Extraction socket preservation (ridge preservation) or extraction socket reconstruction

1) If all the surrounding bone walls, namely, the buccal, palatal (lingual), mesial, and distal, are healthy after tooth extraction, then a bone graft in the extracted socket is not recommended as natural bone healing may perform well (8).
2) If the bone wall of extraction socket is damaged to a great extent, then it may lead to quick penetration of soft tissue into the extraction socket, thereby hampering the bone healing. In many cases, buccal walls are destroyed due to a trauma or periodontitis; a bone graft is recommended in such cases for the reconstruction of damaged bone wall in the anterior teeth area for the required esthetics (9,10).

3) Selection of bone graft materials

(1) In the anterior teeth area which requires aesthetics, a biocompatible material is recommended owing to its slow or rare resorption to maintain the buccal (labial) bone thickness. Xenograft such as anorganic bovine bone, porcine bone, equine bone, and alloplastic material graft such as hydroxyapatite are also considered as good options (11).

(2) In cases with severe or multiple wall defects, an autogenous bone graft is recommended owing to its excellent bone regeneration property when used alone or with other bone graft materials. The use of rhBMP-2 which can promote bone formation in combination with the appropriate scaffold has also been reported to yield good results (12).

(3) However, except for an autogenous bone graft, superiority of other bone grafts, such as allograft, xenograft, alloplastic graft over other each other has not yet been established (13,14).

2. Guided bone regeneration (GBR) (15-17)

1) The GBR for reconstruction in cases with fenestration defect can yield an appreciably better bone regeneration than the cases with dehiscence defect.

2) Leaving less than 2 mm of a dehiscent wound without GBR yields better results.

3) GBR may be useful for small defects. All the biocompatible bone graft materials can be used in such cases without necessitating the use of a barrier membrane.

4) If the defect size is large, it is better to use the autogenous bone together. The implant surface is filled with autogenous bone, while the outer area of the defect is covered by other bone substitutes which exhibit late resorption to finally recover a barrier membrane. The use of rhBMP-2, which promotes bone formation, in combination with an appropriate scaffold also yields good results.

3. Ridge augmentation

Horizontal (lateral) ridge augmentation produces better effects than vertical ridge augmentation. The vertical ridge augmentation using the onlay technique tends to result in a dehiscent wound and loss of bone graft material. Thus, an interpositional bone graft can be
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used to prevent the abovementioned problems. However, it is associated with surgical difficulties and nerve-damaging risks.

1) Blood supply to the bone graft is provided through remains of the alveolar bone and soft tissue of the upper part post reconstruction process in 1-wall defect cases. So, it is difficult to obtain sufficient bone augmentation that may result in complications, such as wound dehiscence, bone loss, and infection. Therefore, it is recommended to include an additional autogenous bone graft to achieve good clinical results (18,19).

2) Clinical outcome and amount of augmentation are not significantly different between the cases with block bone graft and particulate bone graft (20,21).

3) It is safe to aim for an augmentation up to 3~4 mm. However, for an increase of more than 4 mm, distraction osteogenesis or interpositional bone graft is recommended (22).

4) If the volume of augmentation is large, a mixture of autogenous bone graft and other bone graft materials is recommended. However, no specific bone graft material has been proved to be superior. The use of rhBMP-2 which can promote bone formation in combination with an appropriate scaffold also yields good results (12,23-25).

4. Sinus bone graft

If the residual bone height is greater than 5 mm, the surgeons can choose their preferred procedure because it is known that there is no difference between the crestal and lateral approach during sinus elevation and bone graft. There are also numerous studies that report no differences between procedures with bone graft and without bone graft, and also the type of bone graft material. However, if the residual bone height is less than 5 mm, the lateral window technique can produce more stable results. The simultaneous implant surgery or delayed implant placement can be determined according to the initial stability of the implant. Generally, if it is less than 3 mm, delayed implant placement is more stable whereas if it is between 3 mm and 5 mm, simultaneous implant placement is believed to yield a good result.

1) Any biocompatible material can yield good results, if the maxillary sinus is healthy, and there is no large perforation (more than 1 cm) in the sinus membrane during the surgery (26-28).

2) Following are the cases in which an autogenous bone graft should be used (29-32). It has been reported that if an autogenous bone graft is used in the inferior sinus, and xenograft or alloplastic graft is used in the superior sinus, good long-term results can be obtained.

   (1) In case of a wide edentulous area extending in the maxillary region, a massive bone graft is needed.

   (2) In case of a large perforation (>1 cm) of sinus membrane.
(3) In case of simultaneous reconstruction for oro-antral fistula.

(4) In case of poor blood flow and presence of scar-like tissues due to maxillary sinusitis, history of sinus operation, and failure of sinus bone graft.

CONCLUSION

Criteria for selection of implant surgery, type of bone graft, and bone graft material on the basis of lectures at the Amapá society of implantodontics, 2020 and evidence-based sufficient academic backgrounds can be summarized as follows (33,34):

1. Major bone grafts are not recommended in a case with severe atrophic mandibular recession. It is recommended to resolve the problems with a short-length implant whenever possible.

2. A bone graft is not needed in a freshly extracted socket. However, in a case with severe bone wall defects, extraction socket preservation or reconstruction using a bone graft is recommended to prevent penetration of soft tissue and for creation of good conditions for delayed implants.

3. The biocompatible bone substitutes in a sinus bone graft can be used instead of an autogenous bone graft, which shows good bone healing. However, in cases where the condition of maxillary sinus is poor or the range of sinus bone graft is wide, autogenous bone graft should be used to enhance bone healing.

4. Although, distraction osteogenesis and vertical ridge augmentation can be used to vertically increase the alveolar bone; their effect remains unclear.

5. It is recommended to include an autogenous bone graft in ridge augmentation of 1-wall defect.

6. In case of large defects around dental implants, an autogenous bone should be grafted in the implant surface, while other bone substitutes with late resorption are present in the outer area of the defect to finally cover a barrier membrane.

7. The use of rhBMP-2 with bone substitutes has been found to be useful in promoting bone formation. However, the effects of other growth factors, such as platelet rich plasma (PRP), are not clear. The selection of bone graft materials and bone grafts is important. The following criteria need to be followed to achieve a successful bone graft.

   1. Strict sterilization and prevention of infection.

   2. Complete primary closure of soft tissue.

   3. If there is a wide range of defects, an autogenous bone graft should be included.

5. Presence of rich nutritional blood supply. 6. Minimizing the load on the bone-grafted area.

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