Radiographic and histomorphometric evaluation of xenograft and allograft in lateral sinus elevation

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Abstract

The maxillary sinus floor augmentation was performed through lateral approach or transcrestal approach according to residual bone height(RBH). Xenogenic graft(XG), allogenic graft(AG) and alloplastic graft(AP) are commonly used as a bone graft materials.

The aim of this study is to investigate radiographic and histomorphometric evaluation after sinus floor augmentation which were performed using anorganic bovine bone(ABB), minenalized cancellous bone allograft(MCBA) and mixed allogenic bone.

A total of 47 patients who had RBH lower than 5mm below the maxillary sinus were included this study. ABB, MCBA and mixed allogenic graft(cortical FDBA 50% : cancellous FDBA 50%) were used for procedure.

After approximately 6 months, amount of augmented bone height(ABH) and shrinkage of ABH between baseline and 6 months were evaluated by radiographic analysis. In the radiographic examination, amount of augmented bone height(ABH) of ABB, MCBA and mixed allogenic graft was verified. Histomorphometric analysis of bone core biopsies (2mm diameter) was performed to evaluate the proportion of newly formed bone(NFB), residual graft(RG) and connective tissue(CT). In the histomorphometric examination, there were no significant differences in NFB between ABB and MCBA or mixed allogenic graft (P>0.05). However, NFB of MCBA was significantly greater than mixed allogenic graft (P<0.05).

Background and Aim

The maxillary sinus floor augmentation has become an important pre-prosthetic surgical procedure in the posterior edentulous ridge with vertical atrophy.

The maxillary sinus floor augmentation was performed through lateral approach or transcrestal approach according RBH. XG, AG and AP are commonly used as a bone graft materials.

The aim of this study is to investigate radiographic and histomorphometric evaluation after sinus floor augmentation which were performed using ABB, MCBA and mixed allogenic bone.

Methods and Materials

A total of 47 patients(26 males, 21 females) who had RBH lower than 5mm below the maxillary sinus were included this study, ABB(Bio-Oss®, Geistlich, Switzerland), MCBA(Puros®, Zimmer, USA) and mixed allogenic graft(cortical FDBA 50% : cancellous FDBA 50%; Allo-Oss®, CG-bio, South Korea) were used for augmentation [Table 1].

After approximately 6 months, bone core biopsies were harvested from alveolar crest at each augmented sinus using trephine bur with 2mm inner diameter [Fig 1].

Amount of ABH and shrinkage of ABH between baseline and 6 months were evaluated by radiographic analysis.

Histomorphometric analysis was performed to evaluate the proportion of NFB, RG and CT.

	Subjects	Gender		Sites	Mean age
		M	F		
ABB	16	11	5	27	55.2
MCBA	13	6	7	21	49.1
Mixed allo genic graft	18	9	9	29	54.9

Table 1. Data of 3 groups.
A total 47 patients. (ABB; Bio-Oss®, Geistlich, Switzerland. MCBA; Puros®, Zimmer, USA. Mixed allogenic graft; Allo-Oss®, CG-bio, South Korea)

Fig 1. Surgical procedure.
The maxillary sinus floor augmentation procedure through lateral approach(A~C). After approximately 6 months, bone core biopsy was taken and Implant fixture was placed(D~F).

Results

The gap between the repositioned bony window and the intact maxillary lateral wall was healed by newly formed tissue.

In the radiographic examination, ABB(n=13), MCBA(n=12) and mixed allogenic graft(n=27), ABH ware 13.63±4.23mm, 10.80±3.11mm, and 12.79 ± 3.06mm and shrinkage of ABH were -0.12 ± 2.52mm, 2.09 ± 3.20mm and 1.23 ± 1.09mm, respectively. There is no statistically significant difference (p>0.05) [Table 2].

In the histomorphometric examination, ABB(n=27) was composed of 34.60.37±11.72% NFB, 13.87±12.15% RG and 51.80±9.70% CT [Fig 2]. MCBA(n=21) was composed of 38.74±14.38% NFB, 3.68±4.71% RG and 57.42±12.75% CT [Fig 3]. Mixed allogenic graft(n=29) was composed of 30.12±16.62% NFB, 14.93±12.53 and 54.95±12.78% CT [Fig 4].

There is no significant differences in NFB between ABB and MCBA or mixed allogenic graft (P>0.05). However, NFB of MCBA was significantly greater than mixed allogenic graft (P<0.05). There is also a statistically significant difference in between ABB and MCBA, MCBA and mixed allogenic graft(P<0.05) [Fig 5].

Fig 2. Histomorphometric result of XG.
34.9% NFB, 19.8% RG, and 45.3% CT. (H&E stain, x40(left) and x100(right)).

Fig 3. Histomorphometric result of MCBA.
38.3% NFB, 1.1% RG, and 60.6% CT. (H&E stain, x40(left) and x100(right)).

Fig 4. Histomorphometric result of mixed allogenic graft.
32.3% NFB, 8.4% RG, and 59.3% CT. (H&E stain, x40(left) and x100(right)).

	ABH (mm)	Shrinkage of ABH (mm)
ABB (n=13)	13.63 ± 4.23	-0.12 ± 2.52
MCBA (n=12)	10.80 ± 3.11	2.09 ± 3.20
Mixed allogenic graft (n=27)	12.79 ± 3.06	1.23 ± 1.09
p-value	0.732	0.773

Table 2. Results of radiographic evaluation.
No statistically significant difference between 3 groups (p>0.05) (One way ANOVA test). (ABH; augmented bone height)

Fig 5. Results of histomorphometric evaluation.
* Statistically significant difference (P<0.05) (Mann-Whitney test)

Conclusions

ABB, MCBA and mixed allogenic graft showed favorable new bone formation and vertical augmented bone formation. Further studies about implant survival rate with a long-term follow-up after functional loading are needed to confirm the stability of this procedure.

References

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