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Histomorphometry of bone augmentations with Bio-Oss®: A systematic review and meta-analysis

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Results

Figure 1
New bone formation of all specimen included

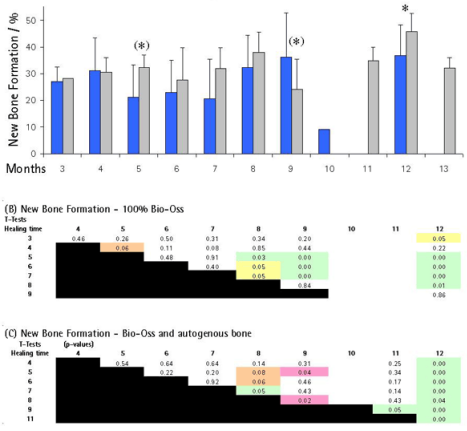

Figure 1: (A) Variation of newly formed bone with time. The specimen in which only Bio-Oss® (Blue) was used were compared to sites treated with Bio-Oss® mixed with autogenous bone (grey); (B) p-Values of the t-test, performed for the variation between Bio-Oss® and Bio-Oss® mixed with autogenous bone. Statistical significance ($p<0.05$) showing a superiority for the addition of autogenous bone (green), or a trends ($0.10>p>0.05$) (yellow). Statistical significance showing superiority for pure Bio-Oss® (red), statistical trends (orange). (C) p-Values of the t-test performed for the difference of newly formed bone between the different time points for 100% Bio-Oss® (top) and (D) Bio-Oss® mixed with autogenous bone (bottom).

Figure 2
Sinus grafting vs ridge augmentation

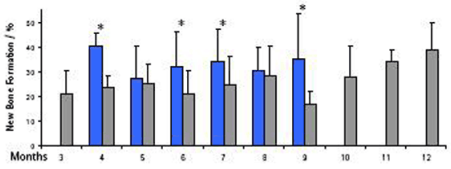

Figure 2: (A) Showing the variation in the newly formed bone with time. The specimen resulting from ridge augmentation (Blue) were compared to sinus floor augmentations (grey); (B) T-test for the variation between alveolar ridge and sinus floor augmentations for each time point. Statistically significant values ($p<0.05$) showing more bone formation in alveolar ridge augmentations are marked in green, statistical trends ($0.10>p>0.05$) in yellow.

Figure 3
New bone formation in sinus floor elevation

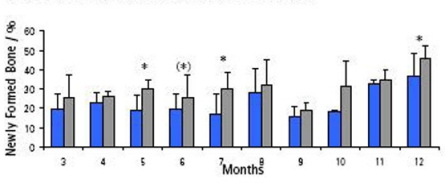

Figure 3: (A) Showing the variation in the newly formed bone with time. The specimen resulting from sinus grafting with 100% Bio-Oss® (Blue) and Bio-Oss® mixed with autogneous bone (B) T-test for the variation between 100% Bio-Oss® and Bio-Oss® mixed with autogenous bone for each time point. Statistical analysis showing more bone formation in for the addition of autogenous bone (green; $p<0.05$), statistical trends ($0.10>p>0.05$) yellow.

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New bone formation in ridge augementation

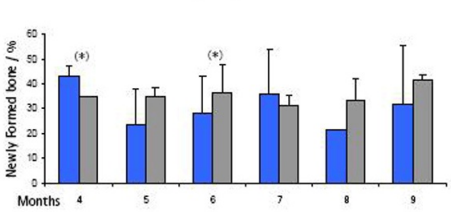
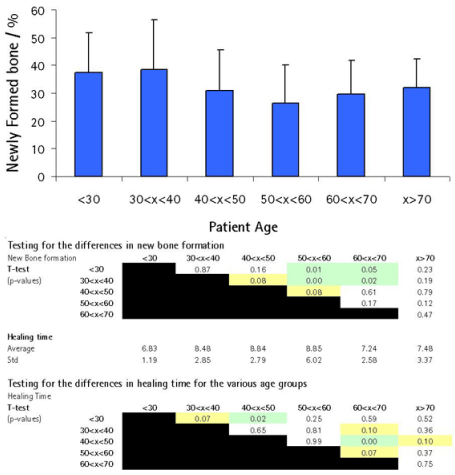


Figure 4: (A) Showing the variation in the newly formed bone with time. The specimen resulting from ridge augmentations with 100% Bio-Oss® (Blue) and Bio-Oss® mixed with autogneous bone (B) T-test for the variation between 100% Bio-Oss® and Bio-Oss® mixed with autogenous bone for each time point. Statistical analysis showing a statistical trends for more bone formation for Bio-Oss® mixed with autogenous bone ($0.10>p>0.05$; yellow). the ones favouring 100% Bio-Oss® are underlain in orange.

Figure 5
Variance of the new bone formation with age



Testing for the differences in new bone formation

New Bone formation T-test (p-values)	<30	30<x<40	40<x<50	50<x<60	60<x<70	x>70
<30		0.87	0.16	0.01	0.05	0.23
30<x<40			0.08	0.00	0.02	0.19
40<x<50				0.08	0.61	0.79
50<x<60					0.17	0.12
60<x<70						0.47

Healing time						
Average	6.83	8.48	8.84	8.85	7.24	7.48
Std	1.19	2.85	2.79	6.02	2.58	3.37

Testing for the differences in healing time for the various age groups

Healing Time T-test (p-values)	<30	30<x<40	40<x<50	50<x<60	60<x<70	x>70
<30		0.07	0.02	0.25	0.59	0.52
30<x<40			0.65	0.81	0.10	0.36
40<x<50				0.99	0.00	0.10
50<x<60					0.07	0.37
60<x<70						0.75

Figure 5: (A) Showing the differences in the amount of newly formed bone in dependence of the age of the patient. (B) T-test for the variation of the amount of newly formed bone between the different age groups. Statistical significance ($p<0.05$) showing a superiority are underlaid in green, statistical trends values ($0.10>p>0.05$) in yellow. (C) T-test for the variation in the healing time between the different group. Statistical significant baseline variations are underlaid in green, and trends in yellow.

Figure 6
Variance of the new bone formation with gender

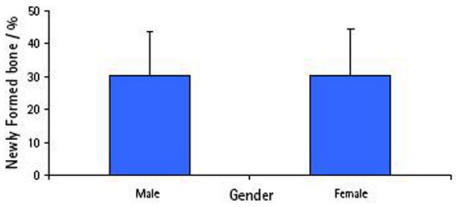


Figure 6: (A) Showing the differences in the amount of newly formed bone in dependence of the gender of the patients. The values are virtually identical.

Figure 7
New bone formation depending on smoking habits

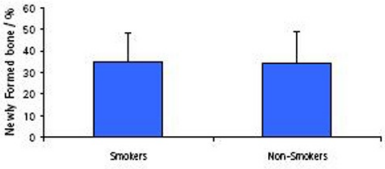


Figure 7: Showing the differences in the amount of newly formed bone in dependence of the fact if the patient is a smoker. The values are virtually identical.

Conclusions

The here presented data show that there is a significant difference in the kinetics of new bone formation when comparing different indication in implantology. Generally, new bone formation is slower in the maxillary sinus than for a ridge augmentation after grafting. Furthermore, the data show that for sinus grafting, the addition of autogenous bone to Bio-Oss® increases the amount of new bone formation up to 12 months after the surgical procedure with respect to augmentations performed with only 100% Bio-Oss®. For ridge augmentations, no such difference could be detected with the present evaluation. Interestingly, it could be shown that the bone formation is lowest for the the age group between 50 and 60 years. However, there was no difference between the genders, indicating that men also exhibit worse bone formation during what is considered the menopause for women. There was no difference for the new bone formation between smokers and non-smokers, however, this could be due to the smokers being generally excluded from most studies. Consequently, only 20 specimen from smokers were found in the literature. The here presented work can give new insight into the identification of risk factors, and into the kinetics of bone formation, after bone grafting with Bio-Oss® with and without addition of autogenous bone. This can lead to a more scientifically based treatment concept -clinical timing and biomaterials used - avoiding potential problems.

References

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- Lee IJPRD 2006;
- Froum IJPRD 2006;
- Galindo-Moreno COIR 2007;

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Poster Faksimile:

Geistlich Biomaterials leading regeneration

Histomorphometry of bone augmentations with Bio-Oss®: A systematic review and meta-analysis

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Abstract

To be able to properly evaluate the risk and the benefit of using commercially available bone substitutes, the material has to be tested both clinically and biologically. One of the main investigation criteria discussed in the literature is the new bone formation within human biopsies obtained at the time of implant placement. As new bone formation is regarded as a direct measure of osteoconductivity, leading to the osseointegration of the dental implant, it is directly related to the success of the implantation. Bio-Oss® has been evaluated in more than 500 Publications of which 45 present histological and histomorphometric data of human specimen. In 25 out of the 45 publication the individual data for each biopsy was reported and used to perform a meta-analysis. A total of 341 biopsies were included. The here presented data cover bone growth rates on Bio-Oss® in different indications and investigate the benefit of the addition of autogenous bone.

Results

Figure 1
New bone formation of all specimen included

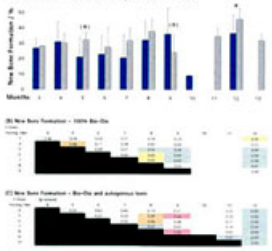

Figure 1: (A) Variation of newly formed bone with time. The specimen in which only Bio-Oss® (Blue) was used were compared to sites treated with Bio-Oss® mixed with autogenous bone (grey). Statistical significance ($p<0.05$) *, statistical tendency ($0.10>p>0.05$) (*) ; (B) to (C) p-Values of the t-test performed for the difference of newly formed bone between the different time points for 100% Bio-Oss® (C) and Bio-Oss® mixed with autogenous bone (D). Statistical significance ($p<0.05$) showing a superiority for a later timepoint (green), or a statistical trend ($0.10>p>0.05$) (yellow). Statistical significance showing superiority for an earlier timepoint are underlain in red, and statistical trends in orange.

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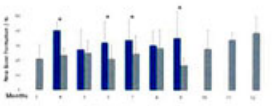
Sinus grafting vs ridge augmentation



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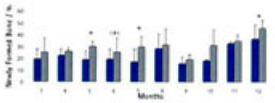
New bone formation in sinus floor elevation



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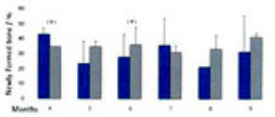
New bone formation in ridge augmentation



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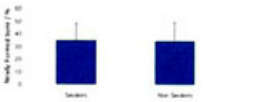
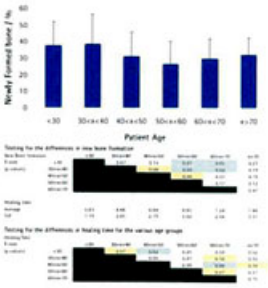


Figure 7: Showing the differences in the amount of newly formed bone depending on the smoking habits. The values are virtually identical.

Figure 5
Variance of the new bone formation with age



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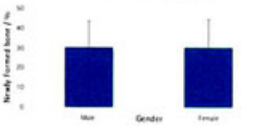

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Discussion & Conclusions

The here presented meta-analysis has to be considered with care, due to the limitations of the small sample size at some of the individual time-points (the most data points were identified for 6 and 12 months). However, the here presented data show that there is a significant difference in the kinetics of new bone formation when comparing different indication in implantology. Generally, new bone formation is slower in the maxillary sinus than for a ridge augmentation after grafting. Furthermore, the data show that for sinus grafting, the addition of autogenous bone to Bio-Oss® increases the amount of new bone formation up to 12 months after the surgical procedure compared to augmentations performed with only 100% Bio-Oss®. For ridge augmentations, no such difference could be detected with the present evaluation. Interestingly, it could be shown that the bone formation is lowest for the the age group between 50 and 60 years. However, there was no difference between the genders, indicating that men also exhibit worse bone formation during what is considered the menopause for women. There was no difference for the new bone formation between smokers and non-smokers, however, this could be due to the smokers being generally excluded from most studies. Consequently, only 20 specimen from smokers were found in the literature.

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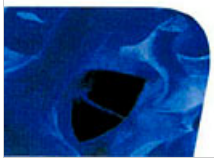

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