<Original Article>

Evaluation of Survival Rate and Crestal Bone Loss of the Osstem GS Ⅱ Implant System

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• Abstract

The survival rate of the OSSTEM GS II Implant 1 year after serving the prosthetic function in 2 domestic and foreign medical institutes was 97.57%; the success rate was 95.7%, and the average alveolar bone resorption was 0.24mm(n=389). In particular, the alveolar bone resorption occurred differently according to the placement location as well as whether or not the patient underwent bone grafting operation, but the implant s length and diameter did not have significant impact on alveolar bone resorption.

• Keywords : GS Ⅱ implant, survival rate
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Introduction

OSSTEM GS Ⅱ Implant is a submerge type with internal hex connection structure; it is characterized by the micro/macro dual thread designed to minimize bone resorption. The surface is treated with RBM (resorbable blast media), with the body design enabling the simple adjustment of placement depth and assuring superb initial stability.

This study examined the survival rate of OSSTEM

GSII Implant and the bone resorption rate 1 year after prosthesis placement based on cases of surgeries performed in 1 domestic and 1 foreign medical institutes.

Materials and Methods

Patients who underwent the Osstem GS Ⅱ Implant (Osstem, Korea) placement surgery at the Department of Dentistry of Bundang Seoul National University Hospital from June 2005 to October 2008 and patients who had placement surgery with the same implant at a dental clinic in Singapore from March 20, 2007 to April 28, 2008 were surveyed. There were a total of 278 patients (146 males and 132 females) and 698 implants placed. Alveolar bone resorption 1 year after the completion of prosthetic placement could be measured among 134 patients (72 males and 62 females) where 389 implants were placed. The success rate and survival rate considered all patients. The implant was considered to have survived when osseointegration was maintained at the current point and was not removed due to symptoms such as mobility and pain. For the success rate of the implant, only those with less than 1.5mm of bone loss for 1 year after placement were included in the calculation. Alveolar bone resorption was measured in patients who had periapical radiograph taken 1 year after the completion of prosthesis.

The region where the implants were placed was divided into 4 groups: upper anterior, upper posterior, lower anterior, and lower posterior. The anterior included teeth from central incisor to canine, and the posterior, premolar and molar. The average bone resorption in each group was measured.

Patients were divided into the case of performing maxillary sinus elevation or horizontal/vertical bone grafting and the case of not performing the above to examine the alveolar bone resorption 1 year after the completion of prosthetic placement in each group.

The implant's diameter was categorized into 4 types from a minimum of 3.5mm to a maximum of 5mm; the average alveolar bone resorption in each group was then measured.

The implant's length was divided into 6 groups from a minimum of 7mm to a maximum of 15mm; the average alveolar bone resorption in each group was then measured.

To examine bone resorption, the distance between the first screw thread to the very top of the resorbed alveolar crest as represented in the parallel periapical radiograph was measured; alveolar bone resorption on the mesial and distal sides were measured with the distance measurement program of IMPAX (Agfa, Belgium), with the average recorded.

SPSS 12.0 (LEAD Technology, USA) was used for the statistical calculation. ANOVA was used to examine the difference in alveolar bone resorption due to placement area and implant's diameter, and independent T-test, to examine the difference in alveolar bone resorption due to bone placement surgery method. The Kruskal-Wallis method was used to verify the significance at $p<0.05$. For the post-hoc test of ANOVA, Tukey's Studentized Range and Duncan's Multiple Range Test were performed; for the post-hoc test of Kruskal-Wallis, the Bonferroni procedure was applied.

Results

Among the 698 GS Ⅱ implants placed, 681 survived until 1 year after placement. The survival rate was 97.57%. Excluding 13 implants that showed 1.5mm or more bone resorption, the success rate was 95.70% (668/698).

The alveolar bone resorption rate measured 1 year after prosthetic loading was applied to GS Ⅱ Implants; it was 0.24mm (n=389) on the average, with minimum of 0mm, maximum of 2.85mm, and standard deviation of 0.47mm.

The difference in bone resorption due to placement location had statistical significance (p= .029); the bone resorption around the implant placed in the upper anterior was 0.12mm (sd= 0.31, n=77), that in the upper posterior, 0.24mm (sd= 0.48, n=166), that in the lower anterior, 0.19mm (sd= 0.36, n=29), and that in the lower posterior, 0.32mm (sd= 0.47, n=117). There was statistical significance between the bone resorption in the upper anterior and that in the lower posterior (Table 1).

Table 1. Installation site and crestal bone loss (ANOVA, p value=0.029)

	Crestal Bone Loss (mm)	n	SD
Upper ant. *	.12	77	.31
Upper post.	.24	166	.48
Lower ant.	.19	29	.36
Lower post *	.32	117	.47

*: Statistically significant difference

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Table 2. Bone graft and crestal bone loss (T-test, p value=0.022)

	Crestal Bone Loss (mm)	n	SD
Bone graft	.19	212	.45
non	.30	173	.50

*not described in 4 fixtures

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Less bone resorption was observed in case bone grafting such as maxillary sinus elevation and horizontal/vertical bone grafting was performed compared to the case when the above was not performed, and the difference was statistically significant (p=.022). Average alveolar bone resorption of 0.30mm (sd=.50, n =173) was observed in case bone grafting was not performed, and average of 0.19mm (sd=.45, n=212) (Table 2), in case it was performed.

Alveolar bone resorption did not show significant difference in relation to the implant's diameter (p=0.691), recording 0.19mm (sd=0.37, n=78) when the diameter was 3.5mm, 0.25mm (sd=0.50, n=129) when the diameter was 4.0mm, and 0.23mm (sd=0.47, n=81) when the diameter was 4.5mm. Alveolar bone resorption was 0.27mm (sd=0.50, n=99) when the diameter was 5.0mm (Table 3).

Alveolar bone resorption showed significant difference in relation to the implant's length (p=0.016), recording 0.23mm (sd=0.33 n=28) when the length was 7mm, 0.12mm (sd=0.30, n=57) when the length was 8.5mm, 0.30mm (sd=0.57, n=115) when the length was 10mm, 0.27mm (sd=0.54, n=97) when the length was 11.5mm, 0.25mm (sd=0.38, n=60) when the length was 13mm, and 0.58mm (sd=0.23, n=3) when the length was 15mm (Table 4).

Table 4. Fixture length and crestal bone loss (Krukal-Wallis test, p value=0.016)

	Crestal Bone Loss (mm)	n	SD
7mm	.23	28	.33
8.5mm	.12	57	.30
10mm	.30	115	.57
11.5mm	.27	97	.54
13mm	.25	60	.38
15mm	.58	3	.23

*not described in 29 fixtures

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Table 3. Fixture diameter and crestal bone loss (ANOVA, p value=0.691)

	Crestal Bone Loss (mm)	n	SD
3.5mm	.19	78	.37
4.0mm	.25	129	.50
4.5mm	.23	81	.47
5.0mm	.27	99	.50

*not described in 2 fixtures

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Discussion

In the past, the success rate of implant placement was only 53% in the upper jaw and 75% in the lower jaw in the early stage of implant development. Note, however, that most implants are recording 95% or higher success rate due to the advancement of surface treatment, design, surgical methods, and prosthetic treatment methods. The implant is considered successful when it satisfies specific conditions after a fixed period of time after the placement; its rate is referred to as the success rate, and the standard for the success rate is less than 1.5mm of bone loss within 1 year of the placement of prosthesis as suggested by Albrektsson and Isidor in 1994[1]. According to previous studies, 3i implant showed a 93.8% success rate in the upper jaw and 97% in the lower jaw[2], whereas Branemark Implant recorded a 94% success rate[3]. For Korean systems, the success rate of Avana Implant - which is the former name of Osstem Implant - was reported to be 96.2%; this was close to the success rates of other systems[4]. Survival rate refers to the rate of cases wherein the implant was not removed due to failures at the current point. This study defined failure as the case wherein each implant has mobility, case wherein the radiolucency is observed around the implant in the periapical radiograph, and case wherein symptoms such as pain, infection, neuropathy, paraesthesia, and intrusion of mandibular canal occur after the insertion of implant[5]. The 97.57% survival rate and 95.70% success rate of GS Ⅱ Implant in this study were generally similar to the values of other systems.

The alveolar resorption rate occurred differently due to the placement location, and the difference was statistically significant. Previous studies reported that more resorption took place in the upper jaw than the lower jaw[6] for the distribution of stress around the implant varies according to the bone mass and bone substance and more stress is

concentrated in the cancellous bone which has less density[7]. In this study, the highest resorption was found in the lower posterior, upper posterior, lower anterior, and upper anterior in respective order, and it suggested that more resorption takes place with poorer bone substance, which is different from the result of previous studies. The reason the most resorption was found in the lower posterior is not clearly known although a number of elements other than bone substance (infection, loading period, etc.) must have affected the resorption.

Studies also reported that more resorption occurred when guided bone regeneration was performed than that when it was not performed[8]. More resorption is expected when guided regeneration is performed for it involves surgical injury and high possibility of complications after the surgery. Note, however, that this study found less resorption when bone grafting was performed. The reason is unclear, requiring further studies on the grafting material, membrane use, and difference in surgical methods.

The alveolar bone resorption in relation to the implant's length and diameter showed that the difference in alveolar bone resorption in relation to the diameter was not statistically significant, and that in relation to the length appeared to be statistically significant in the nonparametric test. Note, however, that the significance between groups did not appear statistically; ditto when the 15mm implants - only 3 of which were placed - were excluded from the statistics. Other studies reported that the increase in diameter resulted in 3.5 times less stress in the alveolar crest, and that the increase in length resulted in 1.65 less stress through finite element analysis; thus suggesting the use of wide and long implants[9].

This study had several limitations. For one, it was a retrospective study that simply analyzed the survival rate and success rate of the alveolar crest. Moreover, this study lacked sufficient evaluation on the cause of excessive bone resorption and failed to unify a number of variables. Although supplemented results will be presented in the future, the fact that it was jointly performed by 1 domestic and 1 foreign organizations makes this study meaningful.

Conclusion

The survival rate of the OSSTEM GS Ⅱ Implant 1 year after serving the prosthetic function in 2 domestic and foreign medical institutes was 97.57%; the success rate was 95.7%, and the average alveolar bone resorption was 0.24mm(n=389). In particular, the alveolar bone resorption occurred differently according to the placement location as well as whether or not the patient underwent bone grafting operation, but the implant's length and diameter did not have significant impact on alveolar bone resorption.

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