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Comparison of values of crestal bone loss around dental implants: A comparative study

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ABSTRACT

Introduction: Many studies have examined values of crestal bone loss according surgical techniques, time of implant placement (immediate post-extraction or after alveolar socket healing), platform switching or convectional platform, surface of the implant, functional loading (immediate or delayed), etc.

Methods: This study analyzed a total of 443 dental implants on 115 images: 161 Bredent blueSKY dental implants and 282 Ritter spiral dental implants. All images were taken at the Faculty of Dentistry of the University of Sarajevo: before implantation and after 1 year of functional loading. Crestal bone loss was measured on the mesial and distal side of each implant from the coronal portion of the abutment to the noticeable margin of the alveolar bone.

Results: There is statistically significant differences between Bredent blueSKY and Ritter spiral dental implants regarding mesial ($p < 0.001$, df = 441, $t_{stat} = -64.22$) and distal ($p < 0.001$, df = 441, $t_{stat} = -151.21$) bone losses.

Conclusion: Platform switching dental implants showed more bone loss on the mesial and distal side of implant than dental implants with conventional platform.

Keywords: Crestal bone loss; implant; platform

INTRODUCTION

Implant stability is affected by crestal bone surrounding an implant, so radiographic evaluation of crestal bone height is very important criteria for assessment of implant treatment success (1,2). Crestal bone loss of 1.5 mm or less is expected normal physiologic reaction during the 1st year of functional loading and will not jeopardize the implant survival. However, crestal bone loss continues after 1 year of implantation. If the value of crestal bone loss <0.2 mm in the following years, it is considered a success and key for long-term implant survival (3-5).

Many studies have examined values of crestal bone loss according surgical techniques, time of implant placement (immediate post-extraction or after alveolar socket healing), platform switching or convectional platform, surface of the implant, functional loading (immediate or delayed), etc. (3-6).

An important factor for the longevity of implant-prosthetic therapy is precisely the mechanical stability of the connection between implant and abutment. There are whole range different systems of dental implants and abutments and different methods of connection. In previous years, external joints were used, which were replaced by internal joints with anti-rotation protection due to better properties (7).

According to some authors, the concept of platform-switching ensures minimal bone loss because of reduction of the loading stress at the bone-implant interface and limited apical extension of the inflammatory cell infiltrate beyond the platform. They found less crestal bone loss around implants with platform-switching than around implants with a conventional platform (8-11).

In the platform-switch system, the diameter of the abutment is less than the diameter of the implant, and that horizontal mismatch offers a larger surface useful for osseointegration. Furthermore, it allows bigger distance between implant abutment interface and crestal bone. If compared to the studies performed on implants with a difference in implant-abutment diameter >0.45 mm and those where the difference was <0.45 mm, mismatches >0.45 mm showed the best outcome (12).

The aim of this research is to compare the values of crestal bone loss around dental implants from different manufactures (Ritter spiral implant and Bredent blueSKY implant system).

METHODS

This study analyzed a total of 443 dental implants on 115 images: 161 Bredent blueSKY dental implants and 282

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Ritter spiral dental implants. Diameter of implants was 3.5 × 10 mm and 4.0 × 8 mm. The measurements of crestal bone loss were performed on panoramic radiographs using Kodak dental software 6.11.7.0. (around Bredent blueSKY implants) and on the cross-section of CBCT image using Sidexis program (around Ritter spiral dental implants). All images were taken at the Faculty of Dentistry of the University of Sarajevo: Before implantation and after 1 year of functional loading. Crestal bone loss was measured on the mesial and distal sides of each implant from the coronal portion of the abutment to the noticeable margin of the alveolar bone. Ethical approval was obtained from the Ethics Committee of the University of Sarajevo - Faculty of Dentistry.

Inclusion criteria were: good quality of images, the clearly visible margin of the alveolar bone, surgical procedures performed at the faculty of Dentistry of the University of Sarajevo, delayed prosthetic loading.

The exclusion criteria were: pathological changes in the region of measurement, peri-implantitis, patients under 18 years of age, patients older than 65 years.

The study is approved by the Ethical Committee of University of Sarajevo - Faculty of Dentistry.

RESULTS

The study included a total of 115 patients, aged from 19 to 63. According to gender, there were 63 (54.8%) male and 52 (45.2%) female patients. Among male patients, there were 75.6% partially dentate and 24.4% totally edentulous. The most females were partially dentate (90.45%), while 9.55% were totally edentulous.

Table 1 shows the mean value of crestal bone loss around Bredent blueSKY and Ritter spiral dental implants.

The mean of mesial and distal resorption around Ritter spiral dental implants was greater than around Bredent blueSKY implants. There are statistically significant differences between Bredent blueSKY and Ritter spiral dental implants regarding mesial ($p < 0.001$, df = 441, $t_{stat} = -64.22$) and distal ($p < 0.001$, df = 441, $t_{stat} = -151.21$) bone losses (Table 2).

TABLE 1. Crestal bone loss in maxilla and mandible

Implant system	Number of implants		Mean value (mm)±SD	
	Bredent sky blue	Ritter spiral	Bredent Sky blue	Ritter spiral
Maxilla	88	170	0.55±0.39	0.88±0.04
Mandible	73	112	0.58±0.32	0.75±0.07

TABLE 2. Crestal bone loss according to sides of implants

Implant system	Number of implants	Mean value (mm)	Standard deviation	*p*-value
Mesial resorption				
Bredent Sky blue	161	0.61	0.35	<0.001
Ritter spiral	282	0. 75	0.09	
Distal resorption				
Bredent Sky blue	161	0.60	0.35	<0.001
Ritter spiral	282	0.93	0.09	

DISCUSSION

In this study, the values of crestal bone loss around dental implants from different manufactures were measured and compared. Implants with similar outer geometry and internal implant-abutment connection for both groups were used which allows conditions for comparison. Also, surgical procedures were performed in two-stage implant surgery for both groups of patients.

Crestal bone loss of the implants after 1 year was less than the critical value (1.5 mm), which may be regarded as successful. The mean bone loss of mandibular and maxillary Bredent skyBlue implants was 0.58 mm (0.32) and 0.55 mm (0.39), and the mean bone loss of mandibular and maxillary Ritter spiral implants was 0.75 mm (0.07) and 0.88 mm (0.04), respectively. This study showed more bone loss on the mesial and distal side of implant for Ritter spiral dental implants than Bredent blueSKY dental implants. Implants of both dental systems are bone-level implant. This is important to point out because some researchers consider that the vertical position of the implant with respect to the bone is the main factor influencing bone loss (13).

A lot of effort has made into discover the causes responsible for the crestal bone loss after implant placement. Most likely, changes in crestal bone are associated with the interaction of more factors. The physical properties of the implants, such as implant design, surfaces, and degrees of roughness influence the crestal bone (13-15).

There are some differences between two used dental systems, so they are possible causes of difference in crestal bone loss. Internal implant-abutment connection used dental implants is similar, but not the same. Ritter spiral has external hexagon which is always parallel to the implant's hidden internal hexagon. Bredent blueSKY has internal Torx, tube-in-tube with six large force transfer surfaces. Implant diameter was 3.5 and 4.0 mm for Bredent and 3.75, 4.2, and 5 for Ritter.

In this study, we obtained higher value of crestal bone loss with implants with platform switching (Ritter spiral) than with conventional platform (Bredent blueSKY). Our results are in agreement with the results of Pan et al. (16) Other authors found lower values of crestal bone loss in implants with a replaceable platform than in implants with a conventional platform (9,10). Lin et al. measured vertical and horizontal marginal bone levels immediately after functional loading (after prosthetic delivery) and 1 year, 3 years, and 5 years after functional loading. They reported a higher vertical marginal bone loss around dental implants with platform-switched abutments (1.67 ± 0.24 mm) than platform-matched (conventional platform) dental implants (0.88 ± 0.17 mm) in the early healing period. At 1-year and at 3-year loading, platform-switching dental implants were less likely to lose bone (17).

CONCLUSION

Crestal bone loss was minimal for both groups of dental implants. Platform-switching dental implants showed more bone loss on the mesial and distal side of implant than dental implants with conventional platform.

DECLARATION OF INTERESTS

Authors declare no conflict of interest.

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