Research Article

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Evaluation of Bacterial Leakage of Two Different Internal Implant Abutment Connections: An Invitro Study

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ABSTRACT

Background: The higher success rate of dental implants >90% over 5 years has made this treatment option favourable for dental surgeons as well was for patients. The present invitro study was conducted to assess bacterial leakage of two different internal implant abutment connections.

Materials & Methods: 40 dental implants divided into two groups. Group 1 fixtures with an internal hexagonal geometry and Group 2 fixtures with a tri-lobe internal connection. All implant abutment assemblies were submerged in sterile tubes containing 4 mL of S. aureus broth culture and were incubated at 37 degree celsius for 2 weeks. The resulting colonies were identified by Gram's stain and biochemical reactions.

Results: The mean Log_{10} CFU in group I was 9.3 and in group II was 8.6. The difference between two groups found to be significant (P< 0.05).

Conclusion: Authors found that microscopic space between implant and abutment may be the site of penetration of bacteria. There was significant higher Log_{10} CFU in dental implants fixtures with an internal hexagonal geometry than dental implants fixtures with a tri-lobe internal connection.

Keywords: Bacteria, Dental implants, S. aureus.

INTRODUCTION

Dental implant therapy has revolutionized the field of dentistry. The higher success rate of >90% over 5 years has made this treatment option favorable for dental surgeons as well was for patients.[1] However, in spite the exceptional success rates in osseo-integration of dental implants, many shortcomings have been mentioned regarding surgical techniques and mechanical microbiological factors. Peri-implantitis is recent and most commonly occurring pathology along the dental implant. Bacteria and their products may cause inflammatory reactions in soft tissues around dental implants. This has opened the eyes to look for various pathologic bacteria responsible for the failure of treatment.[2]

The peri-implant bone loss can lead to proportional gingival recession, resulting in a lower height of the papilla due to the increased distance between the contact point of the teeth and the bone crest.[3] Microbial leakage at the implant-abutment connection is a main challenge for the construction of the two-stage implant systems.[4] The major causes of microbial leakage are gaps and cavities which are formed between the implant and the abutment. This in turns initiates peri-implant inflammatory reactions. It has been observed that fit accuracy between the fixture and abutment, tightening

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torque and micromovements between the connected components during mastication determines the amount of bacterial colonization between the implants and abutments.[5] The present invitro study was conducted to assess bacterial leakage of two different internal implant abutment connections.

MATERIALS & METHODS

The present in vitro study was conducted in the department of Prosthodontic, Bridge & Crown work. The study protocol was approved from institutional ethical committee. It comprised of 40 dental implants (Biohorizon) (3.0 mm X 10 mm) which were divided into two groups of 20 each. In group I fixtures with an internal hexagonal geometry were connected to standard straight abutments with a height of 0.6 cm the abutments were connected to the fixtures with a torque of 25 Ncm and in group II fixtures with a tri-lobe internal connection were connected to 0.3 cm high abutments of 35 Ncm torque.

In present study, staphylococcus aureus was used for the study. A bacterial suspension was prepared by cultivating S. aureus in brain heart infusion (BHI) broth and incubating it for 24 h at 37 degree celcius. The suspension was diluted in nutrient broth to obtain a density of 1 X10^8 colony-forming units per milliliter.

Microbial sampling

Dental implants were removed and held in vertical position to allow firm torque action under strict sterilized conditions. Abutments were then attached with dental implants. Tubes having sterile BHI broth were used for the immersion of implant-abutment assembly for 30 seconds. The tubes were then incubated at 37 degree celsius for 2 weeks.

Following this implant- abutment assembly was submerged in test tubes containing 4 mL of S. aureus broth culture and was incubated at 37 degree celsius for 2 weeks. After 2 weeks of immersion, the assembly was removed and held in 70% alcohol for 3 minutes. Following this, the inner surfaces of the implants were sampled by sterile paper points for bacterial contamination. These paper points were immersed in test tubes containing sterile BHI broth. From the broth, culture was done on blood agar plates and incubated at 37 degree Celsius for 24 hours. The resulting colonies were identified using Gram's stain and biochemical reactions.

Statistical analysis

Results thus obtained were entered in Excel sheets. SPSS version 19.0 for windows was used for statistical analysis. Data were presented as mean, median, standard deviation (SD) and range values. Mann Whitney U test was used to compare between two groups. P value less than 0.05 was considered significant.

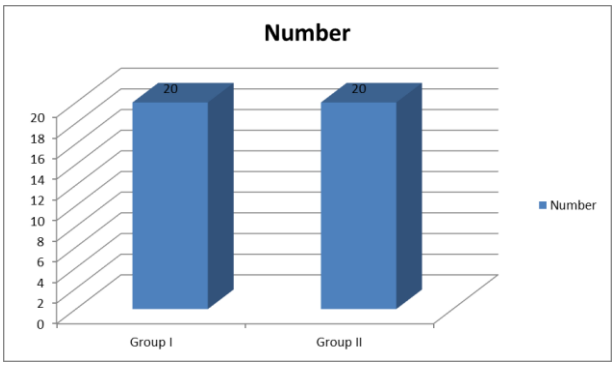
Table 1: Distribution of dental implants.

Groups	Group I	Group II
Fixtures	Internal hexagonal connection	Tri-lobe connection
Number	20	20

Table 2: Comparison between Log10 CFU in the both groups.

Groups	Mean	SD	Median	P value
Group I	9.3	0.4	9.1- 9.5	0.05
Group II	8.6	0.2	8.4- 8.8	

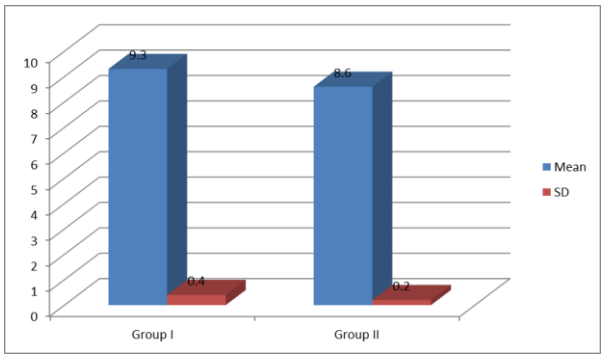
Graph 1: Distribution of dental implants.



RESULTS

Table I, graph I shows that in group I, fixtures was internal hexagonal connection and in group II was tri-lobe internal connection. Each group comprised of 20 dental implants. Table II, graph II shows that mean Log_{10} CFU in group I was 9.3 and in group II was 8.6. The difference between two groups found to be significant (P< 0.05).

Graph 2: Comparison between Log10 CFU in the both groups.



DISCUSSION

The microscopic space between implant and abutment can act as a bacterial niche and favoring the loss of the peri-implant mucosal seal.[6] These micro-gaps may alter the clinical and microbiological parameters of tissues with increase in bacterial load precipitating periodontal diseases which in turns leads to failure in osseointegration. It has been further postulated that these spaces favours penetration of fluids and saliva leading to bacterial invasion.[7]

The gap sizes may alter bacterial contamination. The level of contamination depends on the precision of fit, degree of the applied micro-movement and torque. Broggini et al[8] found infiltration of white blood cells around the implants, which vary according to the implant design. The present invitro study was conducted to assess bacterial leakage of two different internal implant abutment connections.

In present study, 40 dental implants (Biohorizon) (3.0 mm X 10 mm) were divided into two groups of 20 each. In group I fixtures with an internal hexagonal geometry were connected to standard straight abutments with a height of 0.6 cm the abutments and in group II fixtures with a tri-lobe internal connection were connected to 0.3 cm high abutments.

Faria et al[9] conducted an in vitro study and assessed bacterial leakage along the implant–abutment interface, comparing three types of connections: EH, IH and MT. A colony of E. coli was inoculated in the apical portion of abutment screws, which were fixed to implants with a torque of 20 Ncm. Samples with immediate external contamination were discarded, while remaining specimens were placed in test tubes containing TSB. 38 samples with EH, 40 with IH and 41 with MT connections were evaluated. There were no differences between the EH (10.53%), IH (4.88%) and MT (7.50%) connections.

In present study, we the mean Log_{10} CFU in group I was 9.3 and in group II was 8.6. The difference between two groups found to be significant (P< 0.05). Nassar et al[10] conducted a study to evaluate the bacterial leakage of two different internal implant abutment connections. They divided dental implants into 2 groups with 10 dental implants. Internal hexagon implants showed statistically significant higher mean Log_{10} CFU than Tri-lobe implants.

Tesmer et al[11] conducted a study to determine bacterial colonization of the dental implant fixture-abutment interface. Thirty implants were divided into three groups based on their microgap dynamics. Groups 1 and 2 were comprised of fixtures with internal Morse-taper connections that connected to standard abutments. Group 3 was comprised of implants with a tri-channel internal connection. Fixtures and abutments were assembled and allowed to incubate in a bacterial solution of Aggregatibacter actinomycetemcomitans and Porphyromonas gingivalis. Three of the 10 samples in group 1 developed one colony forming unit (CFU) for A. actinomycetemcomitans, whereas zero of 10 samples developed CFUs for P. gingivalis. Ten of 10 and nine of 10 samples from groups 2 and 3, respectively, developed multiple CFUs for A. actinomycetemcomitans and P. gingivalis.

Loutouzis et al[12] evaluated the effect of dynamic loading on the colonization of oral microorganisms in the FAI microgap of dental implants with internal Morse-taper connection. Forty implants were divided into two groups based on subjection to dynamic loading conditions. Both Group 1 and 2 were comprised of fixtures that connected to standard abutments and allowed to incubate in a bacterial solution of Escherichia coli. The specimens of Group 2 were loaded with 500 000 cycles of 50 N using a chewing simulator. 1 dental implant in group I and 4 in group II had FAI microgaps colonized by E coli. Authors suggested that implants with internal Morse-taper connection exhibited minimal bacterial penetration down to the threaded

part of the FAI and that dynamic loading increases the potential for such bacterial penetration.

CONCLUSION

Authors found that microscopic space between implant and abutment may be the site of penetration of bacteria. There was significant higher Log_{10} CFU in dental implants fixtures with an internal hexagonal geometry than dental implants fixtures with a tri-lobe internal connection.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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