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RATE OF MARGINAL BONE LOSS AROUND SCREW-RETAINED AND CEMENT RETAINED SINGLE IMPLANT PROSTHESES - A SPLIT MOUTH STUDY

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ABSTRACT Implant supported restorations have become an integral part of main contemporary dental care. The prostheses can be attached to implants with screws or can be cemented

Aim and Objective: To compare and evaluate rate of marginal bone loss around 30 implant supported screw-retained and cement-retained prostheses for a period of 12 months in a split mouth design

Material and methodology: The sample consists of 30 single tooth implant restorations, placed bilaterally; one on either side of the arch; in 15 patients. The mean age of the sample was 29.4+-8.17 years. The sample was divided in to two groups screw-retained (Group I) or cement-retained (Group II) and were evaluated radiographically for rate of marginal bone loss for a period of twelve months.

Results: The cement -retained implant supported prosthesis had shown significantly ($p>0.05$) more rapid marginal bone loss.

KEYWORDS : Screw-retained, Cement-retained, Screw loosening, Peri-implantitis, marginal bone level, Peri-implant soft tissue, Single implant restorations.

INTRODUCTION

The use of osseointegrated implants has revolutionized dentistry and predictive long-term treatment results have been obtained for replacing partial or complete edentulous spaces. The cumulative survival rates of dental implants ranges from 93.6 % to 96.7 % after three to five years in service (1, 2). Osseointegration of dental implants is the most important and the criteria for a successful implant, which in turn depends on the healthy peri-implant hard and soft tissue. Glossary of Prosthodontics terms defined Osseointegration as " the apparent direct attachment or connection of osseous tissue to an inert, alloplastic material without intervening fibrous connective tissue (3).". Loss of osseointegration clinically manifest as implant mobility, pain, increased pocket depth, bleeding etc. and radiographically as perimplant radiolucency, and marginal bone loss. A number of diagnostic parameters where introduced to monitor implant life. Many authors consider marginal bone loss as the most important criterial for implant success.

Implant supported restorations have become an integral part of main contemporary dental care. The prostheses can be attached to implants with screws or can be cemented (4, 5).The choice of retention (screw vs cement) has an effect on the final occlusal design (6) and is a complex decision involving many points of consideration. The main advantage of screw-retained implant restorations is retrievability, which is convenient in situations such as screw loosening or fracture, hygiene, or modification of the prostheses (7). The advantages of cement retained restorations are good esthetics, good occlusion, simplicity of the technique (8, 9) and a more passive fit compared to screw retained (10, 11). The present study compared and evaluated marginal bone loss around screw-retained and cement-retained prostheses for a period of 12 months in a split mouth design.

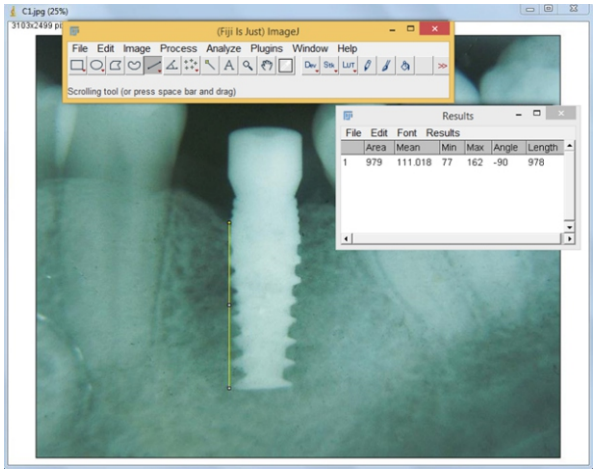
MATERIALS AND METHODS

The sample consists of 30 single tooth implant restorations, placed bilaterally; one on either side of the arch; in 15 patients. The mean age of the sample was 29.4+-8.17 years (range 18 to 45 years). The inclusion criteria were: (a) Patients with bilateral single edentulous space (b) adequate bone quality and quantity (c) good oral hygiene. The implants were placed using 2-stage surgical technique with the help of a surgical template [Figure 1]. All implants (Adin Torague™-S, Adin Implant Systems Ltd) were placed by same prosthodontist under local anesthesia and received either screw- or cemented-retained implant restorations.

Figure 1- Bilateral implants with cover screw

The mesial and distal marginal bone height was measured in standardized intra oral periapical radiographs using the software 'Fiji'; which is an open source image processing program based on ImageJ designed for biological-image analysis [Figure- 2]. The radiographs were taken at 0 (base line) and 12 months of functional loading using the paralleling technique (on a Kodak Ekta speed film) using a film holder (Rinn XCP, Dentsply). The radiographs were then digitized using a flatbed scanner with a resolution of 300 dpi on an 8-bit greyscale.

Figure 2 – MBL measurement using FIJI software



The rate of marginal bone loss is defined as change in bone height parallel to the long axis of implant per unit time and it is calculated as difference in bone levels at two consecutive visits divided by the time

between the visits. The distance from the most coronal bone to implant contact to the apex of the implant was measured on the mesial and distal side of the digitized radiograph parallel to the implant axis. The distance was calculated in pixels and calibrated to millimeters with the help of the known length of the implant. Deducting marginal bone level at 12 months from the bone level at 0 months (baseline) of functional loading gave the bone loss in millimeter on mesial and distal aspects of implant. The mean rate of marginal bone loss around cement- and screw-retained restorations was then compared

STATISTICALANALYSIS

Data were analyzed using the Statistical Package for Social Sciences (IBM SPSS), v16.0. Data were expressed in its mean, median and standard deviation and a two-tailed P value of< 0.05 was taken as the level of significance. Student's t test was used to compare the bone loss between two groups.

RESULTS

The mean age of the included patients was 29.4+-8.17 years (range 18 to 45 years).. The mean marginal bone loss was calculated and compared at 12 months of functional loading for cement-retained and screw-retained single implant restorations and the results are given in Table 1&2 and Figue1 & 2. A statistically significant difference could be found between the two groups at 12 months (p<0.05). The Cement-retained implant restorations showed significantly more marginal bone loss compared to screw-retained implant restorations.

Table 1: Mean Rate of Marginal Bone Loss (mm) at 12 months of functional loading

Parameter	Group	Mean	+ SD	t value	P value
Mesial	Cement	0.68	0.27	-2.386	< 0.05
	Screw	0.90	0.31		
Distal	Cement	0.80	0.24	-2.680	< 0.05
	Screw	1.03	0.23		

Table 2 – rate of marginal bone loss (mm/year) in percentage

	Screw- retained		Cement- retained	
Marginal Bone loss (mm/year)	**Mesial %**	**Distal %**	**Mesial %**	**Distal %**
0	0	0	0	0
0.1-0.5	20	13	0	0
0.6-1.0	67	60	67	53
1.1-2.0	13	27	33	47
>2.0	0	0	0	0
Mean Value	0.68 mm/year	0.80 mm/year	0.90 mm/year	1.03 mm/year

Figure 3: Comparison of mesial and distal MBL between two groups at 12 months of functional loading

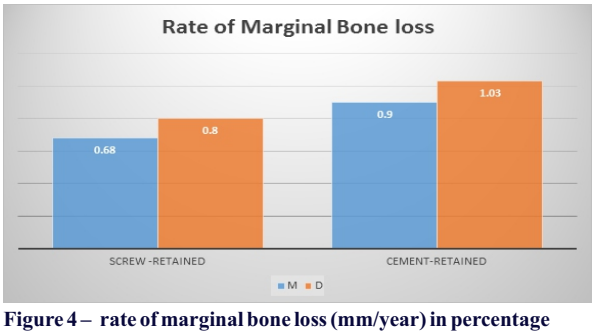
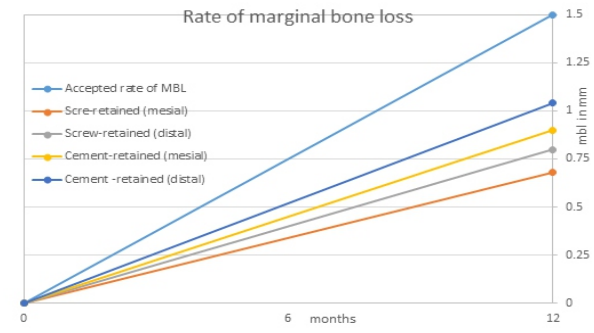


Figure 4 – rate of marginal bone loss (mm/year) in percentage



DISCUSSION

Implant supported prosthesis have become an integral part of prosthodontic rehabilitation of partially edentulous patients. A 5-year survival rates of 96.03% and 95.55% for cemented and screw retained reconstructions, respectively have been reported in the literature (12). Both cement- and screw retained implant restorations have their advantages and limitations. The main advantage of cement retention is the easy achievement of passive fit due to the cement layer and are the choice of prosthesis when implants are inclined. But the excess cement trapped in such restorations can cause peri-implant mucositis and peri-implantitis (13, 14). The principal advantage of screw-retained implant restorations is retrievability, which is convenient in situations such as screw loosening or fracture, hygiene, or modification of the prostheses (7). The main drawback of screw retained restorations are lack of versatility in design and suffer from inherent mechanical complications such as screw loosening and fractures (15, 16) .

Many parameters have been introduced to assess success of implant restorations. Marginal bone levels, measured with periapical radiographs, are a commonly used parameter for the assessment of implant success(17). Crestal bone loss can be assessed by intraoral periapical radiographs or by bitewing radiographs. Radiographic evaluation is a noninvasive method that can be performed at any stage of healing (18). Marginal bone loss can only be reliably measured when the central ray of the x-ray source is parallel with the implant axis. Moreover, conventional periapical radiographs do not provide information on a facial bone level, and bone loss at this level precedes mesiodistal bone loss. About 40-50 % of demineraiazion had to occur to be detect radiographically (19).

Rapid Marginal bone loss (MBL) around implants could endanger its life and most implants demonstrate initial bone loss “to the first thread,”(20). This “standard MBL” stabilizes at approximately one year. Many etiologic factors have been hypothesized for MBL, including surgical trauma, occlusal overload, peri-implantitis, microgap, biologic width, and implant crest module (21). Immobility, absence of peri-implant radiolucencies, absence of pain, absence of infections and less than 0.2 mm vertical bone loss per year (after the first year) were the criteria put forward by Albertson et al. evaluate implant success (22). An implant is considered radiographically successful when marginal bone loss was less than 0.2 mm/year (starting from the first year)(23). Permitted marginal loss in the first-year ranges from 1 mm to 1.5 mm.

In the present study, a significant difference could be found in the rate of marginal bone loss around screw-retained and cement retained supported prosthesis at 12 months of functional loading. Sailer et al. in a systematic review reported that biological complications such as marginal bone loss > 2 mm occurred more frequently at cemented crowns (5-year incidence: 2.8%) than at screw retained crowns (5-year incidence). Screw-retained reconstructions are more easily retrievable than cemented reconstructions and, therefore, technical and eventually biological complications can be treated more easily. For this reason and for their apparently higher biological compatibility, these reconstructions seem to be preferable (24). Millen et al. also reported significantly higher rates of technical and biologic complications were seen for cement-retained prostheses (25). Even though the present study was a longitudinal one, to fully understand the time space relationships as they affect an individual case, there is a need for comprehensive study using a larger sample and long term follow up.

CONCLUSION

The rate of marginal bone loss around screw and cement-retained implant restorations were studied prospectively for twelve months of functional loading period, in thirty single tooth implant supported prostheses. The means age of the sample was 29.4+-8.17 years. In all cases, the patients maintained extremely high oral hygiene level and the implants were placed perpendicular to the occlusal place. It could be concluded that a significant differences existed in terms of marginal bone loss between the 2 groups at twelve months of functional loading.

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