CEMENT-RETAINED PROSTHESES INCREASE RISK OF PERI-IMPLANTITIS WHEN COMPARED TO SCREW-RETAINED PROSTHESES

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ABSTRACT

Peri-implantitis is a dental plaque-associated inflammatory process characterized by bone crest resorption and the formation of peri-implant pockets. Plaque accumulation around implants is influenced by the quality of adaptation between the implant and its prosthetic components, which, in turn, may be dependent on the type of prosthetic system used. The aim of this study was to investigate whether cement-retained implant prostheses are greater risk factors for peri-implantitis than screw-retained prostheses, due to cementation line, which is located in the subgingival portion, serving as a local secondary etiological factor. 107 implants of 25 patients (with 32 cement-retained and 75 screw-retained prostheses) in function for a minimum of 6 months were evaluated based on peri-implant probing depth, bleeding on probing and radiographic bone loss. Overall, peri-implantitis was diagnosed around 63 implants (58.88%) of which 81.2% with cement-retained prostheses and 49.3% with screw-retained prostheses. Chi-Square analysis revealed a significant association between the use of cement-retained prostheses and the presence of peri-implantitis (p=0.004). Moreover, radiographic bone loss was greater around implants with cement-retained prostheses than in those with screw-retained configurations (2.39 and 1.84mm respectively, p = 0.001, Student t test). These results suggest that cement-retained prostheses increase both radiographically detectable bone loss around implants and the risk of peri-implantitis.

UNITERMS: Implant-Supported Dental Prosthesis; Dental Implants; Peri-implantitis. R Periodontia 2014; 24:12-16.

INTRODUCTION

Osseointegrated implants have brought a new dimension to oral rehabilitation, yielding good long-term results for a great number of patients. Both the success and longevity of dental implants depend on their integration with bone and surrounding soft tissues. If this does not occur the implant will be lost. Osseointegration may also be initially achieved but then later lost following prosthesis installation or implant function due to either mechanical overload or peri-implantitis (Adell et al., 1990).

A range of pathological changes that take place in peri-implant tissues are generically termed “peri-implant diseases”. The inflammatory process located only in the soft peri-implant tissues is called “peri-implantar mucositis” whereas “peri-implantitis” refers to an inflammatory process that has progressed into the supporting peri-implant bone causing bone crest resorption, migration of the junctional epithelium and formation of a peri-implant pocket (Lekholm et al., 1986; Lang & Berglundh, 2011).
Peri-implantitis has been shown in many aspects to be very similar to periodontitis. This similarity may be observed in regard to their microbial biofilm associated ethiology, pathogenic microbiota involved, pathogenesis of bone loss, formation of peri-implant pockets by migration of junctional epithelium and other features (Quirynen & Teughels, 2003).

It is known that implant, cement-retained prostheses are potential risk factors for periodontitis. This is particularly true when the cement line is located subgingivally and solubilization of the cement provides a favorable microenvironment for the proliferation of anaerobic gram-negative bacteria (Sánchez-Gárces & Gay-Escoda, 2004).

Implant supported prostheses were originally conceived to be predominantly screw-retained. This type of prosthetic configuration is less retentive for bacterial biofilms because of the fact that prosthetic components are industrially fabricated with high precision equipments without the interference from either the dentist or the prosthetist. Nevertheless, cemented prosthetic configurations have increasingly been preferred by dentists due to the possibility of achieving passive adaptation of the infrastructure with greater easiness (Callan & O’Mahony, 1998).

Although there is a vast variety of possible causes for bone loss around dental implants, an iatrogenic cause, which became the subject of several articles, is the dental cement remainder in peri-implant sulcus. There are case reports describing that the presence of cement led to significant inflammation and bone loss around restored dental implants.

The aim of this study was to investigate whether cement-retained prostheses represent a greater potential risk factor for peri-implantitis when compared to screw-retained prostheses.

MATERIAL AND METHODS

Sample

One-hundred and seven implants (65 male, 42 female patients) Lifecore implants (Lifecore Biomedical, Chaska, MN, USA) from 25 patients of a private practice were used for the study. Patient mean age was 52.9 ± 14.5 years. All implants were in function for at least 6 months at the time of examination.

Smokers, patients with diabetes mellitus or osteoporosis, as well as, patients rehabilitated with the immediate load protocol were excluded from the study.

Ethical considerations

This study was submitted to and approved by the Ethics Committee of the Potiguar University - Brazil [number: 0169.0.052.000-07].

Clinical and radiographic exams

After general patient identification, data were collected on the dates of implant placement and prosthesis installation. Clinical examination was performed to record both peri-implant probing depth (PPD) and bleeding on probing (BOP) using a standard Glickman periodontal probe (Trinity®, São Paulo - Brazil). Radiographic periapical examination of each implant was performed [paralleling technique] with periapical films (Kodak Ektachrome). The exposure time used and processing of the film follow the manufacturer’s recommendations.

All radiographic exams were captured with a digital camera (Sony Cybershot T-30) on a tripod support with a standardized distance between the camera and the film controlled by a a digital pachymeter tip (Starrett® Digital Caliper) calibrated in 1 mm. The digitalized images of the radiographs were subjected to analysis with ImageTool Version 3.0 software [UTHSCSA, San Antonio, Texas]. This analysis consisted of a measurement of the distance between the bone crest and the platform of the implant (implant-abutment interface) using for software calibration the image of the calibrated tip of the pachymeter, visible in all digital images.

Diagnostic Criteria for Peri-implantar Mucositis and Peri-implantitis

A diagnosis of peri-implantar mucositis was established for all implants presenting bleeding on probing but with no evidence of radiographic bone loss greater than 2mm. A diagnosis of peri-implantitis was reached when the radiographic distance between the implant platform and the bone crest was greater than 2mm.

Statistical analysis

The Chi-square test and Odds Ratio analysis were used to investigate possible correlations between the presence of peri-implantitis and cemented prostheses.

For a quantitative analysis of both the amount of radiographic bone loss and probing depth in patients with cemented- and screw-retained prostheses the data were subjected to a Student’s t-test.

RESULTS

Prevalence of Peri-implantar Mucositis and Peri-implantitis

According to the diagnostic criteria used in this study, as shown on Table 1, 16 implants (14.95%) were diagnosed with peri-implant mucositis and 63 with peri-implantitis (58.88%).

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Table 1 - Prevalence of Peri-implantar mucositis and peri-implantitis.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy Implants</td>
<td>28</td>
<td>26.17</td>
</tr>
<tr>
<td>Peri-implant Mucositis</td>
<td>16</td>
<td>14.95</td>
</tr>
<tr>
<td>Peri-implantitis</td>
<td>63</td>
<td>58.88</td>
</tr>
<tr>
<td>Total</td>
<td>107</td>
<td>100</td>
</tr>
</tbody>
</table>

Qualitative association between Peri-implantitis and cemented implant-supported prosthesis

As shown on Table 2, the percentage of implants with cemented prostheses diagnosed with peri-implantitis was 81.2%, whereas peri-implantitis was only detected in 49.3% of the implants with screw-retained prostheses. The Chi-Square analysis revealed a statistically significant association between diagnosis of peri-implantitis and implants with cemented prosthesis (p=0.004), with an Odds Ratio of 4.45.

Table 2 - Association between the Presence of Peri-implantitis and Cemented Prosthesis

<table>
<thead>
<tr>
<th></th>
<th>Perimplantitis</th>
<th>Control</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw-retained Prosthesis</td>
<td>37 (49.3%)</td>
<td>38 (50.7%)</td>
<td>75 (100%)</td>
</tr>
<tr>
<td>Cement-retained Prosthesis</td>
<td>26 (81.2%)</td>
<td>6 (18.8%)</td>
<td>32 (100%)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>63 (58.8%)</td>
<td>44 (41.2%)</td>
<td>107 (100%)</td>
</tr>
</tbody>
</table>

Quantitative comparison of probing depth and bone loss between cemented and screw-retained prosthesis.

As shown on Table 3, the mean probing depth of implants with cemented prostheses was 2.11 ± 0.13mm and in implants with screw-retained prostheses 2.09 ± 0.07mm with no significant differences (p=0.89) between the two groups.

Table 3 - Mean and Standard Deviation (SD) of Peri-implant Probing Depth (PDP) of Implants with Cement-retained and Screw-retained Prosthesis, in Millimeters

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cemented</td>
<td>32</td>
<td>2.11</td>
<td>0.13</td>
</tr>
<tr>
<td>Screw-retained</td>
<td>75</td>
<td>2.09</td>
<td>0.07</td>
</tr>
</tbody>
</table>

On the other hand, as shown on Table 4, implants with cemented prostheses presented a mean bone loss of 2.39 ± 0.82mm, whereas mean bone loss in implants with screw-retained prostheses was of 1.84 ± 0.74mm. These differences were statistically significant (p=0.001).

Table 4 - Mean and Standard Deviation of Radiographic Bone Loss of Implants with Cement-retained and Screw-retained Prosthesis (in millimeters)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cemented</td>
<td>32</td>
<td>2.39</td>
<td>0.82</td>
</tr>
<tr>
<td>Screw-retained</td>
<td>75</td>
<td>1.84</td>
<td>0.74</td>
</tr>
</tbody>
</table>

DISCUSSION

Implant failure may occur at two distinct moments. First, it may be caused by the lack of osseointegration in which a fibrous tissue instead of bone is seen in contact with the implant surface. Such type of failure is called “early failure” because it takes place before the implant be subjected to occlusal loading. This is mainly associated with problems during the surgical phase such as bone overheating, lack of primary stability or bacterial contamination. Late failures, on the other hand occur after loading and are usually due to either occlusal overloading related to errors in prosthetic planning/execution or peri-implantitis (Sánchez-Gárces & Gay-Escoda, 2004).

Peri-implantitis is a clinical condition in which there is an inflammation of the peri-implantar mucosa associated with loss of peri-implant bone support (Sánchez-Gárces & Gay-Escoda, 2004). The etiology and pathogenesis are similar to periodontitis and the typical signs of peri-implantitis lesions include radiographic evidence of cervical vertical bone loss (saucer- or cup-like shape) around the implant with osseointegration still evident on its apical segment (Ericsson & Lindhe, 1993). Such bone resorption may be associated with peri-implant pocket formation (Mombelli & Lang, 1998). Bleeding or suppuration on probing may also be observed, as well as, soft tissue swelling or hyperplasia. However, pain is not a common finding (Sánchez-Gárces & Gay-Escoda, 2004).

Successful implants present mean probing depths of approximately 3 mm with an additional 1 mm from the tip of the probe to the bone crest (Tomasi & Derks, 2012). However, it is known that probing depths may vary according to both the thickness of the peri-implant mucosa and penetration of the probe tip into the healthy connective tissue contact zone. Therefore, probing depth cannot be considered a reliable peri-implantitis diagnostic parameter as it is in the diagnosis of periodontitis (Abrahamsson & Soldini, 2006). Likewise,
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bleeding on probing may also be observed in disease-free peri-implant mucosa and again this may be due to penetration of the probe into the connective tissue contact zone (Ericsson & Lindhe, 1993).

In the present study, probing depth and bleeding on probing were not used as defining parameters for peri-implantitis. A diagnosis of mucositis was given when there was bleeding on probing with mucosal erythema, edema or hyperplasia and 0 to 2 mm of radiographic bone loss measured from the platform of the implant to the most coronal bone/implant contact point.

The detection of radiographic bone loss greater than 2 mm was the only diagnostic criteria for peri-implantitis used in this study based on the assumption that two-stage implants have an initial bone loss following the installation of the prosthetic component to allow the formation of the biological width, i.e. formation of the junctional epithelium and a connective tissue contact zone. A review of the literature suggests that this initial bone loss, which occurs within the first year of implant function, is of approximately 2 mm (Adell et al. 1981; Berglundh & Lindhe, 1996).

By using these diagnostic criteria in the present study, the prevalence of peri-implant mucositis and peri-implantitis were of 14.95% and 57.01%, respectively. Such prevalence is greater than in some reports previously published and is probably due to the more strict criteria used (2 mm of radiographic bone loss) (Ferreira et al., 2006). These data are however similar to that of Callan et al. (1998), where 77% of 270 implants presented bone loss of 3 millimeters or more. Strict diagnostic criteria favor early diagnosis and therefore more successful treatments.

In this study there was a higher percentage of implants with peri-implantitis in patients with cemented-prosthesis implants (81.2%) than in patients with screw-retained implants (49.3%). These findings strongly suggest that implants that support cemented-prostheses are more susceptible to peri-implantitis than implants supporting screw-retained prostheses. The results of the Odds Ratio analysis indicate that the risk for peri-implantitis is 4.45-fold greater in implants bearing cemented prostheses when compared to those with screw-retained prostheses.

The threshold of 2 mm of radiographic bone loss used to qualitatively establish the diagnosis of peri-implantitis is, of course, open to debate. To complement these data, therefore, a more objective quantitative analysis was performed in which the amount of bone loss between the implant platform and bone crest was measured in both cement-and screw-retained implant prostheses.

This analysis revealed that average radiographic bone loss in cement-retained implant prostheses was significantly greater than in screw-retained implant prostheses (2.39 and 1.84 respectively; p=0.001). However, probing depths did not show such differences (2.11 and 2.09 respectively; p=0.89). As already mentioned above this was probably due to the fact that probing depth is not a precise parameter for establishing the diagnosis of peri-implantitis.

CONCLUSION

Based on the diagnostic criteria used and the results observed it may be concluded that cement-retained prostheses increase both radiographically detected bone loss around implants and the risk of peri-implantitis.
REFERENCES


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