SYSTEMATIC REVIEW

Impact of screw retained versus cement retained implant-supported prosthesis on peri-implantitis: A systematic review and meta-analysis

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Abstract

Purpose: The aim of this study was to test the significant differences of the marginal bone loss (MBL) between screw retained versus cemented prosthesis.

Materials and Methods: A comprehensive electronic searching in PubMed and Cochrane databases up to July 2015 with language restriction to English only. We include any randomized controlled trials compare between screw retained versus cemented retained implant prosthesis regarding MBL. In addition, a manual searching was performed for related journals from January 2011 to May 2015. A meta-analysis was performed on all included studies by using a random effect model (mean, 95% confidence intervals [CI]) to pool the effect size as a heterogeneity among studies was high (P < 0.0001 and I² = 88%).

Result: Initial screening and manual searching result in 199 articles from which only 4 articles compatible with our inclusion criteria. No statistical significance was found between screw retained and cemented retained prosthesis regarding MBL (confidence interval CI = 95 and P = 0.26).

Conclusion: No strong evidence to support the difference between screw retained and cemented retained implant prosthesis in the amount of MBL as a measure for peri-implantitis.

Keywords
Cemented retained, implant prosthesis, marginal bone loss, peri-implantitis, screw retained

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Introduction

Nowadays, dental implant is one of the most success treatment modalities in dentistry. However, this treatment modality is accompanied with many complications that may eventually lead to implant failure. Implant-supported reconstructions can be secured to implants with screws (screw-retained) or via cementation on abutments (cement-retained).

Each type had its advantages and disadvantages in comparison with the other regarding ease of fabrication, cost, esthetics, access, occlusion, retention, incidence of loss of retention, retrievability, passivity of fit, restriction of implant position, effect on peri-implant tissue health, porcelain fracture, and clinical performance. However, the choice between screw- and cement-retained implant prostheses still a controversial issue among practitioners.

For both screw retained and cemented retained prosthesis, peri-implantitis is one of the worse complications which involve the progressive destruction of peri-implant tissue and bone loss that may eventually lead to implant failure. It is considered that the success of dental implants when ≤ 1 mm of marginal bone loss (MBL) after the 1st year of function and ≤ 0.2 mm annually thereafter has been occurred.

An in vitro studies evaluating marginal discrepancies of the implant-to-prosthetic interface for either a cemented or a screw-retained approach reveal a smaller marginal micro-gap around screw retained prostheses than around cement retained prostheses.

Furthermore, it is reported by a multicenter in vivo study that the peri-implant soft tissue responds more favorably in the terms of low plaque index and bleeding on probing to screw retained restoration when compared to cemented retained restoration.

Furthermore, the previous systematic reviews reveal also controversies as (Sailer et al., 2012) reported that cemented retained restoration exhibited more serious biological complications. In contrast, (Brandao et al., 2013) stated that...
there is no evidence to support the difference in marginal bone loss and (Sherif et al., 2013) reported no significant difference between two types.\cite{6,10,11}

Among this dilemma we still need clear evidence to answer which type screw retained or cemented retained restoration could associated with less occurrences of peri-implantitis? To obtain robust evidence we include in this systematic review only randomized controlled trials (RCTs) studies with follow-up not <1 year.

Materials and Methods

A formulated focused problem, intervention, comparator, outcome (PICO) question of this systematic review was in patients needing dental implant rehabilitation could the screw retained restoration result in equivalent occurrences of peri-implantitis when compared to cemented retained restoration? A prior protocol for This systematic review was made and registered in at PROSPERO International prospective register of systematic reviews (PROSPERO 2015:CRD42015023922 Available from (http://www.crd.york.ac.uk/PROSPERO_ REBRANDING/display_record.asp?).

Search strategy

This systematic review was conducted in accordance with the preferred reporting items for systematic reviews and meta-analyses statement.\cite{12} Comprehensive electronic search was performed in both PubMed and the Cochrane central register of controlled trials databases up to 10 July 2015 with language restriction to English only. Furthermore, a manual search in the related journals from January 2011 to May 2015 including; clinical implant dentistry and related research, clinical oral implants research, journal of dentistry, and journal of clinical periodontology. We also screened the bibliographies of included studies and check relevant review articles for studies not identified by the search strategies above. The study type was restricted to RCTs.

Search terms

The combination of the following terms which represent P, I AND C elements of PICO format was performed: (Complete edentulous patients OR complete edentulous patients OR completely edentulous patient) OR complete edentulous patients OR edentulism) OR total edentulous OR totally edentulous OR complete edentulous ridge OR complete edentulous ridges OR completely edentulous arch OR completely edentulous arch OR total absent of teeth OR total edentulism OR totally edentulous patients OR partial edentulous patients OR partial edentulism OR partial edentulous patients OR partial edentulous ridge OR partially edentulous ridge OR partially edentulous arch OR partially edentulous arch OR partial absent of teeth OR partial edentulism OR single missing tooth OR single tooth loss OR partially edentulous patients) AND (dental implant OR implant OR root form implant OR endosseous implant OR osseointegrated implant OR dental implants OR dental implantology) AND (screw retained prosthesis OR screw retained bridge OR screw retained crown OR screw retained restoration OR screw retained denture OR hybrid prosthesis OR fixed detachable prosthesis OR combination prosthesis OR non-cemented retained prosthesis OR screw retained restoration OR screw retained prosthesis) AND (cemented retained prosthesis OR cemented retained bridge OR cemented retained restoration OR cemented retained crown OR cemented retained denture OR fixed bridge OR fixed restoration). Furthermore, the following filter: (RCT [Publication Type]) OR controlled clinical trial [Publication Type]) OR (clinical trial as topic [mesh: noexp]) OR (randomized [title/Abstract]) OR (placebo [Title/Abstract]) OR (randomly [Title/Abstract]) OR (trial [Title])) NOT (Animal [MeSH Terms]) NOT (Human [MeSH Terms]) were used in PubMed database to include RCT studies only, whereas in Cochrane database this filter not used because there is inherent filter for trial studies already incorporated.

Inclusion criteria

1. Any study concern with rehabilitation of completely edentulous or partially edentulous patients (population) with screw retained prosthesis (intervention) in comparison with cemented retained prosthesis (comparator) involving evaluation of their effect on peri-implant tissue (outcome measure) was included
2. Follow-up at least 12 months
3. RCTs studies
4. Human study

Exclusion criteria

1. Case report, case series studies, or non-RCT
2. Animal and in vitro studies
3. Follow-up <1 year.

Studies selection

The search process results in 118 articles after duplication removal from which 114 articles were excluded by filtration from titles and abstracts. After full-text article were assessed for their eligibility, four articles\cite{2,13-15} are included due to their eligibility with inclusion criteria with only one study\cite{16} was excluded due to not fulfill the inclusion criteria (the reason for exclusion was due to the authors do not compare directly between screw retained and cemented retained prosthesis). The researching process from initial screening to final inclusion for 4 studies eligible for qualitative and quantitative assessment as seen in Figure 1.

Data extraction

Two reviewers were extract data independently from each eligible study. From the included studies, in the final analysis,
the following data were extracted: Study authors, year of publication, number of patients, number of implant, gender, mean age in years, follow-up period, success/survival rate, and MBL. Also, we attempt to contact some study authors for possible missing data, and the characteristics of included articles are shown in Table 1.

Results

In this review, all of included studies performed a direct comparison between cement- and screw-retained prostheses with respect to peri-implant MBL. All included studies reported a well-defined period of follow-up (4-10 years). The main reason for dropouts among all studies is patients were moved from the area.

![Figure 1: Screening process used to identify eligible studies](image)

Table 1: Characteristics of the included studies of screw- and cement-retained prosthesis

<table>
<thead>
<tr>
<th>Study's Authors/ years</th>
<th>Number of patients</th>
<th>Gender</th>
<th>Age mean value</th>
<th>Number of implants</th>
<th>Follow-up period</th>
<th>Success/survival rate (%)</th>
<th>Marginal bone loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vigolo et al. (2004)</td>
<td>Total=12</td>
<td>Unclen</td>
<td>Uncler</td>
<td>24 implants</td>
<td>4 years</td>
<td>100 success</td>
<td>Cement=0.8±0.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Screw=0.8±0.4</td>
</tr>
<tr>
<td>Nissan et al. (2011)</td>
<td>Total=38</td>
<td>Male=16</td>
<td>59±6 years</td>
<td>221 implants</td>
<td>Screw retained=</td>
<td>100 success</td>
<td>Screw retained</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female=22</td>
<td></td>
<td></td>
<td>66±47 months for</td>
<td>1.4±0.6 mm, cemented (0.69±0.5 mm)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>the cemented=61±40 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vigolo et al. (2012)</td>
<td>Total=18</td>
<td>Male=8</td>
<td>33 years</td>
<td>36 implant</td>
<td>10 years</td>
<td>Cumulative implant</td>
<td>1.1±0.2 mm for both types</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female=10</td>
<td></td>
<td></td>
<td></td>
<td>success rate of 93.7</td>
<td>of restorations</td>
</tr>
<tr>
<td>Crespi et al. (2014)</td>
<td>Total=28</td>
<td>Male=13</td>
<td>59.3±16.2 years</td>
<td>272 implants</td>
<td>8 years</td>
<td>Survival rate of 99.27</td>
<td>Cemented=−1.23±0.45 mm,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female=15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>screw=−1.01±0.33 mm</td>
</tr>
</tbody>
</table>
Meta-analysis

The meta-analysis for the included studies was performed to assess the same comparisons and outcomes. We use the mean difference for the continuous outcome (MBL) using random effect model in a software program (RevMan 5.3, 2014).

All 4 included studies results were pooled using the random model effect as statistical heterogeneity among studies was significance where ($I^2 = 88$ and $\chi^2 = 25.90 P < 0.0001$). The mean difference of MBL which used in this meta-analysis as an outcome measure for peri-implantitis between screw retained and cemented retained prosthesis for all pooled results were 0.18 ($-0.13-0.50$) with 95% confidence interval. This overall estimate is statistically non-significant with $P = 0.26$. The meta-analysis was made with random effect model for the continuous outcome (MBL) as seen in Table 2.

Graph 1: Risk of bias graph: Review authors’ judgments about each risk of bias item presented as percentages across all included studies

Graph 2: Risk of bias summary: Review authors’ judgments about each risk of bias item for each included study

Table 2: Forest plot of comparison: 1 screw retained versus cemented retained prosthesis, outcome: 1.1 marginal bone loss (mm)

Discussion

The objective of this systematic review was to determine if there is a real difference between screw retained and cemented retained prosthesis in the term of peri-implantitis complication that expressed as MBL. Peri-implantitis is a progressive destruction of peri-implant tissue and can be evaluated by gingival index, plaque index, and MBL. However, in this review we select only the MBL as a measure for peri-implantitis because it is the most important indicator and most of trial basically evaluates peri-implantitis via MBL measurement.

In contracts to previous systematic reviews in the same topic which include both RCTs, prospective and retrospective studies, we attempt in this systematic review to reach robust evidence by including only a randomized clinical trials because this type of studies is regarded as high quality studies in scientific hierarchy. In addition, the previous systematic reviews not include RCT comparing both treatment modalities, but instead they collect studies of cemented retained, screw retained separately and thereafter compare them indirectly.[6,11]

A minimum of 1-year of follow-up was considered an inclusion criterion to minimize bias, due to the results reported by Adell et al., 1981[18] exhibiting that the MBL around osseointegrated implants occurs mostly during the first year of function and, in the majority of implants system, tends to stabilize afterward.[15]

Assessment of included studies for possible risk of bias was made independently by the two reviewers using Cochrane tool for risk of bias assessment that is regarded as one of the best tools nowadays by many authors and scientific associations.[17]

The result of the meta-analysis reveal that screw retained prostheses resulted in less MBL compared with cement retained prostheses, but this difference did not reach statistical significance.

The cemented retained restoration was reported to be associated with more peri-implantitis due to present of excess cement which may lead to swelling of soft tissue, soreness, bleeding or exudation on probing, and resorption of peri-implant bone.[6,19-23]

Furthermore, the screw retained prosthesis has been found to produce tighter margins than cemented retained prosthesis. In addition, it has been stated that the interface of machined components is superior to any cement margin that can be developed. As a consequence with cement-retained restorations, there is always a risk of colonization of space with microflora which may result in cement dissolution and gingival inflammation. This finding is compatible with the meta-
analysis of this systematic review and supported by many other studies.\(^1\)\(^2\)\(^3\)\(^4\)

The limitations of this systematic review including; all included studies were at high risk of bias, the overall sample size of included studies was relatively small to reveal the real effect of both treatment modalities and the substantial heterogeneity present among studies included in the review. Another possible limitation is we include articles published only in English language which could bring a source of bias. Also, in this review we depend only on the MBL as a measure for peri-implantitis due to little or no data on other criteria among articles, and we recommend the further studies should be made with evaluating all other criteria of peri-implantitis such as plaque index, probing depth, gingival index beside MBL. Finally, interpretation of this systematic review results must be performed with cautions as the overall of included studies were at high risk of bias.

**Conclusion**

Still there is no strong evidence to reveal the real difference, if any, between screw retained and cemented retained implant prosthesis regarding their effect on peri-implant tissue. A high quality with low risk of bias RCT with large sample size and long follow-up period more than one year to evaluate the differences between them is mandatory.

**Acknowledgment**

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**References**

23. Chee W, Felton DA, Johnson PF, Sullivan DY. Cemented versus