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Research Article

Radiographic Study Of Edge Alignment, Ultrasound Framing And Residual Cement In Prosthetic Dentures Reliant On Dental Implants A Systematic Review And Meta-Analysis

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Abstract

Aim: the aim of present Systematic Review and Meta-Analysis was evaluate Residual Cement in Prosthetic Dentures Reliant on Dental Implants.

Method: From the electronic databases, PubMed, Scopus, LILACS, Web of Science, EBSCO, LIVIVO, and Embase have been used to perform a systematic literature until May 2021. Therefore, a software program (Endnote X8) has been utilized for managing the electronic titles. Effect size with 95% confidence interval (CI), fixed effect model and Inverse-variance method were calculated. Random effects were used to deal with potential heterogeneity and I^2 showed heterogeneity. I^2 values above 50% signified moderate-to-high heterogeneity. The Meta analysis have been evaluated with the statistical software Stata/MP v.16 (The fastest version of Stata).

Result: In the first step of selecting studies 311 studies were selected to review the abstracts, in the second step, the full text of 34 studies was reviewed, finally, six studies were selected. The Survival rates of implants was 91% (ES, 91% 95% CI = 75%-100%). Bleeding on Probing was observed in 60% of implants with excess cement (ES, 60% 95% CI = 45%-76%) (Figure3).

Conclusion: The present study shows that residual subgingival cement contributes to the onset and progression of peri-implant mucositis. Dentists should evaluate the soft tissue parameters around the implant regularly when examining cement-repaired implants.

Key words: Residual Cement, Prosthetic Dentures, Dental Implants, subgingival cement, peri-implant mucositis

Introduction

dental implantology   is an important strategy that can overcome many of the limitations of fixed or removable prostheses(1, 2), That overcome many of the limitations of conventional fixed or removable prostheses(3). Prostheses can be connected to the implant fixture by screws or they can be cemented onto the implant(4). Cement retaining prostheses that are supported by implants are often used to repair lost teeth due to their greater ease of construction and lower overall cost compared to screw retaining prostheses(5). Cement-retained prostheses can lead to retention of cement under the gums around the implant, resulting in biological complications of the implant prosthesis such as bleeding, bone loss, increased probing depths(6). A study found that higher plaque index and more bleeding were seen around cement retaining prostheses(7). Another study reported that screw retaining crowns have statistically smaller margin gaps than cement retaining crowns(8).There are many ways to identify excess cement around implants. One of the most common methods is radiography(9), the study showed that many existing dental cements are not able to detect radiography(10). Another method is endoscopy, which is more reliable than the method and can show the extra cement attached to the implant or its surface with white reflectivity(11). However, it has not been shown that residual subgingival cement can increase the biological effects of dental implants. Therefore the aim of present Systematic Review and Meta-Analysis was evaluate Residual Cement in Prosthetic Dentures Reliant on Dental Implants.

Methods
Search strategy
From the electronic databases, PubMed, Scopus, LILACS, Web of Science, EBSCO, LIVIVO, and Embase have been used to perform a systematic literature until May 2021. Therefore, a software program (Endnote X8) has been utilized for managing the electronic titles.

This systematic review has been conducted on the basis of the key consideration of the PRISMA Statement–Perfumed Reporting Items for the Systematic Review and Meta-analysis(12), and PECO strategy (Table1).

Selection criteria
Inclusion criteria
1. Dental implants
2. cement-retained fixed dentures
3. Clinical parameters
4- Randomized controlled trials studies, controlled clinical trials, prospective and retrospective cohort studies and in vitro studies
5. English language

Exclusion criteria
1. Observational studies, reviews, case-control studies, case report and animal studies
2. Incomplete or inconsistent data for the purpose of the present study.

Table1. PECO strategy

PECO strategy	Description
P	Population: Anyone who receiving dental implants
E	Exposition: biological complications around peri-implant tissues

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C	Comparison: cement-retained vs screw-retained restorations
O	Outcome: implant failure and bone loss

### *Study selection, Data Extraction and method of analysis*

The data have been extracted from the research included with regard to the study, years, study design, Sample Size, Type of Restoration, Follow-up, Cement, Biological Complications, and Excess Cement. criteria proposed by Clementini et al.,(13) used to assessed quality of studies . This scale measures five dimensions (selection, inclusion/exclusion criteria, follow-up, validated measurements, and statistical analysis) with a total of 5 items. In the analysis, Get a full score (5) that means low risk of bias, Get a 4 score that means moderate risk of bias and missing 2 or more means high risk of bias.

For Data extraction, two reviewers blind and independently extracted data from abstract and full text of studies that included. Prior to the screening, kappa statistics was carried out in order to verify the agreement level between the reviewers. The kappa values were higher than 0.80.

Effect size with 95% confidence interval (CI), fixed effect model and Inverse-variance method were calculated. Random effects were used to deal with potential heterogeneity and I^2 showed heterogeneity. I^2 values above 50% signified moderate-to-high heterogeneity. The Meta analysis have been evaluated with the statistical software Stata/MP v.16 (The fastest version of Stata).

Result

According to the purpose of the study, in the initial search with keywords, 314 articles were found. In the first step of selecting studies 311 studies were selected to review the abstracts. Then, studies that did not meet the inclusion criteria were excluded from the study (277 article). In the second step, the full text of 34 studies was reviewed. Finally, six studies were selected (Figure1).
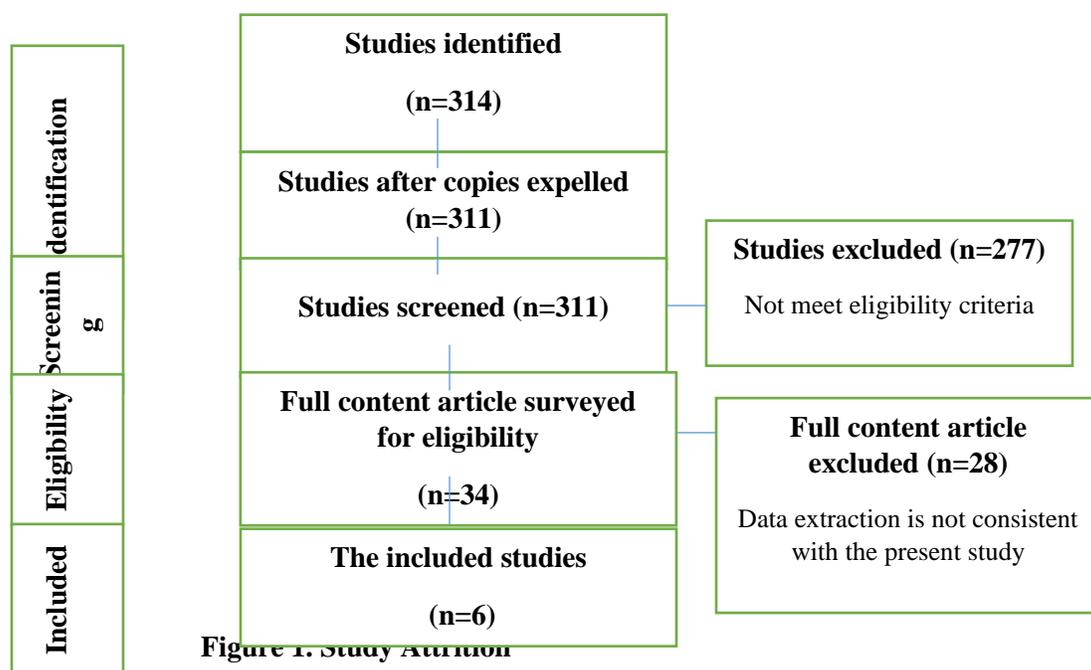
Figure 1. Study Attrition

Characteristics

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Six studies (five retrospective studies and two in-vitro studies) have been included in present article. The number of patients was 324 and the number of implant was 640. The mean of Excess Cement was 57.91%, the mean of follow up was 3.8 years. Three studies nor reported follow-up (Table2). One study reported the radiographic assessment of crestal bone loss. One study reported pocketing depth, two studies reported loss of peri-implant attachment levels.

Bias assessment
Two studies had low risk of bias and three studies had medium quality or moderate risk of bias and one study had high risk of bias.

Table2. Studies selected for systematic review and meta-analysis.

Study. Years	Study design	Number of patients	Number of implant	Type of Restoration	Cement	Excess Cement (%)	Follow-up
Jagathpal et al.,2021 (14)	In-vitro	-	20	NR	alcium aluminate glass ionomer cement	52	NR
Hidalgo et al.,2021 (15)	In-vitro	-	44	NR	alcium aluminate glass ionomer cement and zinc phosphate cement	58	NR
Korsch et al.,2015 (16)	retrospective	71	126	Single crowns, multiple unit bridges	Methacrylate cement	59.5	4 years
Korsch et al.,2015 (17)	retrospective	105	198	NR	Methacrylate cement	62	4 years
Korsch et al.,2014 (18)	retrospective	71	126	Single crowns, multiple unit bridges	Methacrylate cement Zinc oxide euegenol cemen	59.5	261 days

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Linkevicius et al.,2013 (13)	retrospective	77	126	Single crowns, fixed partial dentures, splinted crowns	Resin modified glass ionomer cement	56.6	NR

Survival rates of implants

The Survival rates of implants was 91% (ES, 91% 95% CI = 75%-100%). The range of Survival rates of implants was between 75% to 100% (Figure2).

Bleeding on Probing

Bleeding on Probing was observed in 60% of implants with excess cement (ES, 60% 95% CI = 45%-76%)(Figure3).
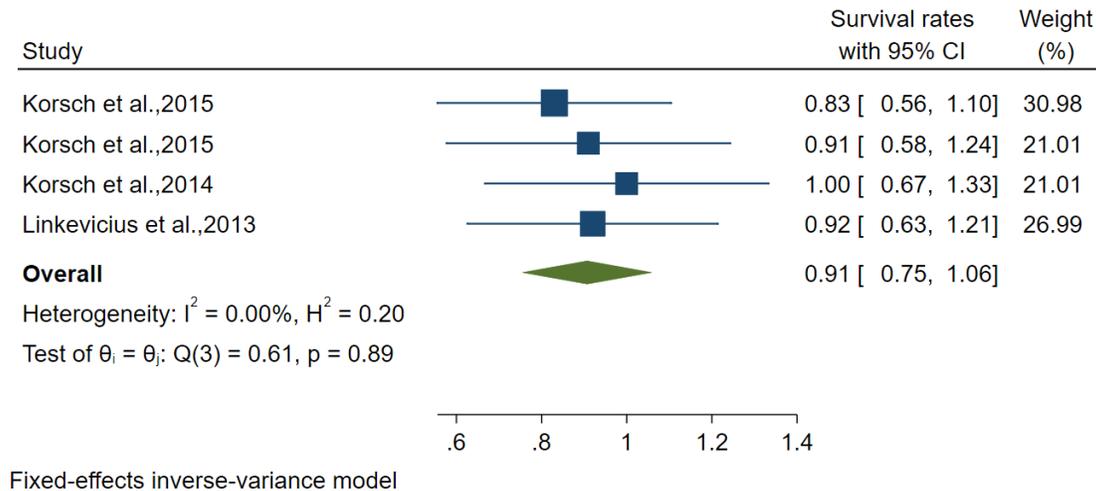
Figure2. Survival rates of implants

Study		Effect Size with 95% CI	Weight (%)
Korsch et al.,2015		0.54 [0.27, 0.81]	31.77
Korsch et al.,2015		0.46 [0.09, 0.83]	17.25
Korsch et al.,2014		0.94 [0.59, 1.29]	19.22
Linkevicius et al.,2013		0.54 [0.27, 0.81]	31.77
Overall		0.60 [0.45, 0.76]	

Heterogeneity: I^2 = 32.99%, H^2 = 1.49

Test of $\theta_i = \theta_j$: Q(3) = 4.48, p = 0.21

Fixed-effects inverse-variance model
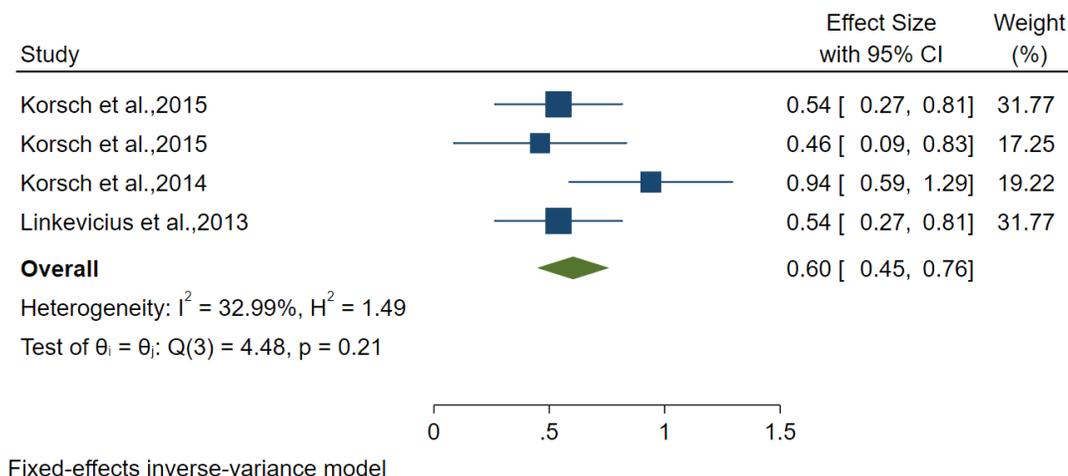
Figure3. Bleeding on Probing

Suppuration

Suppuration was detected in 15% cement (ES, 15% 95% CI = 4%-34%)(Figure4).

Study		Effect Size with 95% CI	Weight (%)
Korsch et al.,2015		0.12 [-0.15, 0.39]	46.56
Korsch et al.,2015		0.24 [-0.13, 0.61]	25.28
Korsch et al.,2014		0.12 [-0.23, 0.47]	28.16
Overall		0.15 [-0.04, 0.34]	

Heterogeneity: I^2 = 0.00%, H^2 = 0.15

Test of $\theta_i = \theta_j$: Q(2) = 0.30, p = 0.86

Fixed-effects inverse-variance model
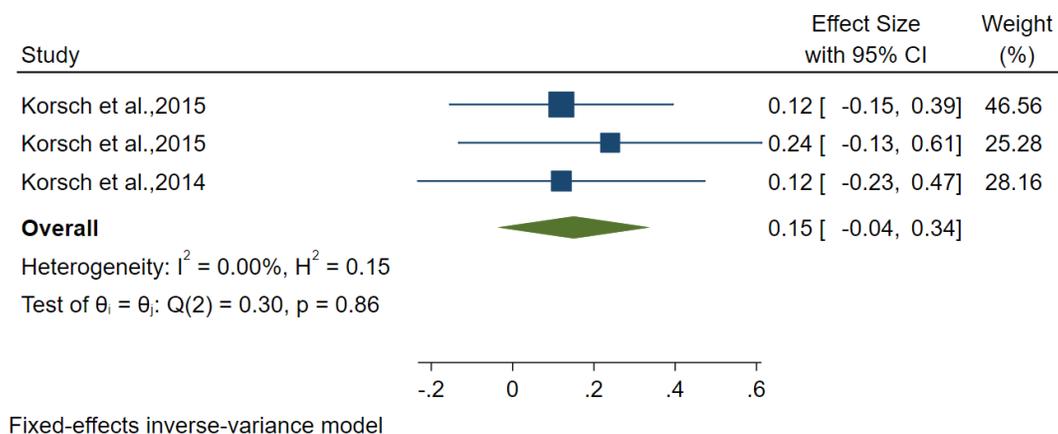
Figure4. Suppuration

Discussion

In the present study, the effect of residual cement on biological complications around dental implants was investigated. Studies in this area were few and most studies did not indicate the main variables, in each case six studies were selected. Two studies were in-vitro and four studies were cohort. According to table 1, mean of Excess Cement was 57.91%. This percentage was similar in almost all studies.

Studies have shown that the mucosa around the implant is a risk factor, especially for the onset of peri-implant(19). Table 1 shows that cements, alcium aluminate glass ionomer cement, zinc phosphate cement,

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methacrylate cement, zinc oxide euegenol cement and resin modified glass ionomer cement were used. There are several methods that can be used to identify Residual cement(19). The evaluated clinical parameters were bleeding on probing and bone loss, suppuration. In almost all studies, bleeding on probing and suppuration was present in most of the remaining cemented implants.

The results are consistent with studies by Pauletto et al., Shapoff et al., and Stancari et al. of the remaining cemented implants (20-22).

The present study had limitations, including the methods of data collection and analysis performed in different studies, although the heterogeneity between the results of the studies was low and this shows that these results can be cited, more studies with the same working method and the same analysis method required in the future. The same clinical parameters were not reported in all studies, especially in laboratory studies, the improvement of biological effects related to cement left after implantation was not evaluated in any of the studies. Further studies are needed to achieve better results and provide strong and sufficient evidence.

Conclusion

The present study shows that residual subgingival cement contributes to the onset and progression of peri-implant mucositis. Dentists should evaluate the soft tissue parameters around the implant regularly when examining cement-repaired implants. These assessments should include depth of digging, bleeding in the probing, and other signs of inflammation. A radiographic examination should be performed to check for bone and residual cement loss. Further studies in this field and with the aim of the present study are needed to find solid results and evidence.

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