

# **Crown Cementation as a Risk Factor of Peri-implantitis: A Systematic Review**

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## **Abstract**

**Introduction:** Cemented crowns are usually used on implant abutments instead of screw retained crowns. The amount of cement excess that is left in the peri-implant tissues depended on depth of crown margins. The remnants of cement in peri-implant tissues can trigger inflammatory response because it is considered as foreign body.

**Methods:** Electronic databases was searched including MEDLINE and EMBASE using PubMed search engine. Furthermore, the search will be conducted in databases and repositories of grey literature such as Open Grey and OAIster. The databases of systematic review and clinical trials such as Cochrane libraries and Center for Reviews and dissemination were screened for eligible primary studies. Based on the primary screening results the irrelevant studies, duplicated and reviews were excluded. We used checklists contain items used to judge the quality of sampling, data collection, statistical analysis, in addition to risk of bias within included studies.

**Results:** Five of included studies evaluated only implants supported single crown and five studies assessed different types of implants supported single crowns or FPDs. Only one study, randomized clinical trial, focused on implants supported FPDs using

split mouth design. The site of implant placement were different, however commonly anterior teeth, bicuspid teeth, and first molars. Concerning type of cementation, zinc oxide cements were reported in some studies, other studies used glass ionomer cement, resin cement, zinc phosphate cement, and temporary cements. Only two studies reported the detection of cement remnant, while other studies reported use of procedures to reduce or remove the excess cement.

**Conclusions:** Peri-implant disease has been shown to be associated with residual cement in particular to patients with predisposing periodontal disease. Cement remnants in patients without history of periodontitis may cause less severe peri-implant disease or may not predispose infection at all. Screw-retained implant restorations might be considered in periodontally susceptible patients.

**Keywords:** Implant, Periodontitis, Cement, Inflammation, Crown.

## Introduction

Several factors are associated with development of peri-implantitis which could be patients' factors or iatrogenic factors. Patients-related factors can be either local or general. Local factors include plaque accumulation and absent of keratinized gingiva around the implant, while general factors include genetic predisposition, presence of debilitating diseases such as diabetes mellitus, smoking, history of periodontitis [1]. The iatrogenic factors such as roughness and structure of the implant surface, presence of implant supra-structure connection, implant overload, and excess cement. [2]. When several studies compared the microbiota of periodontitis with this of peri-implantitis, the authors found more divers microbiota in plaque surrounding periodontitis than that from plaque samples taken from peri-implantitis [3-5].

Generally, patients with a history of periodontitis had significantly deeper peri-implant pocket, more loss of bone, greater occurrence of peri-implantitis in comparison to those with good periodontal health [6, 7]. In many studies, the risk of implant failure is doubled in persons with a history of periodontal diseases in comparison to the periodontally healthy people [8, 9]. The compressive strength of implant on the supported bone can result in bone loss and many studies linked the overload to the peri-implantitis in animal models [10]. Cemented crowns are usually used on implant abutments instead of screw retained crowns. The remnants of cements are frequently disseminated to the surrounding tissues despite of clinician efforts to control the cementation [11]. The amount of cement excess that is left in the peri-implant

tissues depended on depth of crown margins [12]. The radiographic examination failed to detect excess cement in most cases already had excess cement which limited the use of x-rays in detection of this problem [12]. The remnants of cement in peri-implant tissues can trigger inflammatory response because it is considered as foreign body. This review aimed to highlight the effect of crown cementation on the development of peri-implantitis.

## Methods

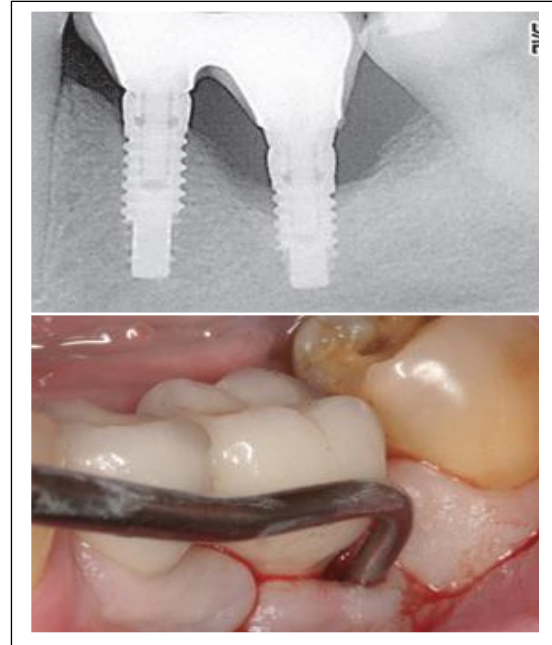
Electronic databases was searched including MEDLINE and EMBASE using PubMed search engine. Furthermore, the search will be conducted in databases and repositories of grey literature such as Open Grey and OAIster. The databases of systematic review and clinical trials such as Cochrane libraries and Center for Reviews and dissemination were screened for eligible primary studies. Keywords such as "Dental implant" OR "Implantitis" AND Screw OR cement AND "bone loss" OR "bleeding on probing" OR "pocket depth" were used to find eligible articles. The titles and abstracts of these articles were screened to identify eligible studies. Based on the primary screening results the irrelevant studies, duplicated and reviews were excluded. We used checklists contain items used to judge the quality of sampling, data collection, statistical analysis, in addition to risk of bias within included studies. The final judgment on quality of included studies were summarized in four grades (high, moderate, low or very low). Only randomized clinical trials were included in this review.

## Results and discussion

The randomized clinical trials recruited smaller samples than those recruited in other studies, where only 33 patients with single implants [13] or 38 patients with multiple implants [14]. All included studies compared the cement retained implants to the implants with screw retention except one study who compared them to porcelain veneers baked directly on custom-made titanium abutments [15]. Five of included studies evaluated only implants supported single crown [13, 15-18] and five studies assessed different types of implants supported single crowns or FPDs [11, 19-22]. Only one study, randomized clinical trial, focused on implants supported FPDs using split mouth design [14]. The site of implant placement were different, however commonly anterior teeth, bicuspid teeth, and first molars.

The role of cement remnants in the etiology of peri-implant disease may be compared to the function of dental calculus in the development of the periodontal disease. It has been stated that there is no etiologic association between the subgingival calculus and periodontal disease development, but the subgingival calculus may acts as a predisposing factor due to additional retention of bacteria and mechanical irrigation of the periodontal tissues.

Concerning type of cementation, zinc oxide cements were reported in some studies [16, 21, 22], other studies used glass ionomer cement [11], resin cement [13], zinc phosphate cement [21], and temporary cements [14, 18]. Only two studies reported the detection of cement remnant [11, 18], while other studies reported use of procedures to reduce or remove the excess cement. One study used cemented crown to the abutment outside the mouth [15], while other only cemented the occlusal half of the crown to decrease the extra-coronal cement [16]. The comparison between cemented and non-cemented type of retention were conducted using all or some of the previously mentioned clinical indices. A similar view may be applied to the peri-implant tissues, as cement remnants act like pieces of calculus. Cement has a rough surface, which has a tendency for bacterial accumulation with subsequent tissue inflammation. It has been shown that bacteria in the sulcus may cause perimucositis,



which later can develop into peri-implantitis, with a resulting bone loss. Three studies aimed to assess the prevalence of periimplantitis in cemented and non-cemented groups of implants. One included study found a higher prevalence of bleeding on probing in cement retained group (31.6%) than that in screw retained group (25%) [22]. Another study found that 85% prevalence of periimplantitis among cement retained implants with detected cement remnant and 30% prevalence of periimplantitis among cement retained implants without cement remnant. Among screw retained group, only 1.1% developed periimplantitis [11]. Another explanation of the difference in the time of peri-implant disease development may be the distance between cement remnants and crestal bone. During cementation, excess cement may not escape through the sulcus, but can be pushed further subgingivally.

In contrast to teeth, the peri-implant tissues lack resistance to pressure due to the absence of an attachment to the implant surface. Connective tissue fibers do not attach to the implant and align themselves parallel along the fixture surface. Subsequently, the periimplant tissues may be less resistant to pressure

compared with tissues around teeth. Several studies have shown that pressure ranging from 20 to 130 N can be developed during the cementation of crowns. The duration of the follow-up period found to affect the outcomes of the implant. The majority of these studies followed the patients for more than 5 years period [11, 14-16, 21, 22]. Some studies have a mean follow up period between 1-5 years [17-19], while two studies have early assessment of outcomes in less than one year [13, 20]. The ability of dental cement to initiate peri-implant disease is not a new issue. Clinical reports suggest that early peri-implant disease may develop within several weeks or months, if cement is not properly cleaned. Thus, excess cement has been considered as a risk factor for rapid onset of inflammation or bone loss, but was not discussed as a cause for delayed peri-implant pathology. Late bone loss was attributed to the periodontal infection, overloading, or plaque accumulation. However, in light of our findings in this review, cement remnant should be considered as a possible contributing factor in late bone loss around implants.

### Conclusions

Peri-implant disease has been shown to be associated with residual cement in particular to patients with predisposing periodontal disease. Cement remnants in patients without history of periodontitis may cause less severe peri-implant disease or may not predispose infection at all. Cement remnants should be considered as an additional predisposing factor in development of chronic peri-implant disease. Finally, screw-retained implant restorations might be considered in periodontally susceptible patients.

### Conflict of interests

The authors declared no conflict of interests.

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