Implant Surface Decontamination by Surgical Treatment of Periimplantitis: A Literature Review

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Introduction: *The purpose of this review was to evaluate the available published clinical studies to understand the current data on the decontamination efficacy of various agents used in the treatment of periimplantitis and reosseointegration.*

Materials and Methods: *An electronic PubMed literature search was conducted for studies published from 1998 until 2018. Literature on clinical studies was included in the review. Of the 189 studies retrieved from the literature search, 33 articles were selected for the review.*

Discussion: *The available studies reviewed had great heterogeneity to conclude a single treatment of choice for implant surface decontamination for the surgical treatment of periimplantitis.*

Conclusions: *Existent data do not favor any decontamination approaches and fail to show the influence of a particular decontamination protocol on surgical therapy. Further clinical investigations are needed to determine the superiority of a decontamination method if existing. (Implant Dent 2019;28: 173–176)*

Key Words: periimplant infection, surgical treatment outcomes, reosseointegration

Decontamination methods for periimplantitis are aimed to remove bacterial biofilm in the periimplant site, including the pocket and implant surface, and to allow reosseointegration or at least to minimize bacterial adhesion. Various methods have been advocated for the decontamination of implant surfaces following surgical exposure. Mechanical, chemical, or photodynamic measures along with laser therapy have attempted to eliminate infection, resolve inflammation, and render the surface conducive to bone regeneration and possible reosseointegration. The objective of this review is to address the following: (1) efficacy of different types of decontamination methods in human trials, (2) effectiveness of photodynamic and laser therapy for decontaminating infected implant surfaces.

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METHODS

Search Strategy and Data Collection

An electronic PubMed literature search was conducted for studies published from 1998 until 2018. The following terms were used in the literature search: treatment and re-osseointegration/peri-implantitis/periimplantitis decontamination and titanium implants and peri-implantitis/periimplantitis; decontamination and titanium implants/biofilm removal; biofilm/plaque bacterial adhesion and peri-implantitis/periimplantitis; decontamination/cleaning and titanium disks and plaque/biofilm; biofilm/plaque removal and re-osseointegration/peri-implantitis/periimplantitis; chemical/mechanical cleaning and peri-implantitis/periimplantitis; and photodynamic therapy/laser and peri-implantitis/periimplantitis. Literature on clinical studies were included in the review. Of the 189 studies retrieved from the literature search, 33 articles were selected for the review (Fig. 1).

Review of Outcomes and Discussion

Most clinical studies on the surgical treatment of periimplantitis have used various methods aiming at decontaminating/detoxifying the implant surface.[1–3] In addition to the infectious nature of peri-implant disease, the obstacle is the inherent difficulty in the mechanical cleansing of the implant surface. The presence of threads frequently coupled with a rough surface

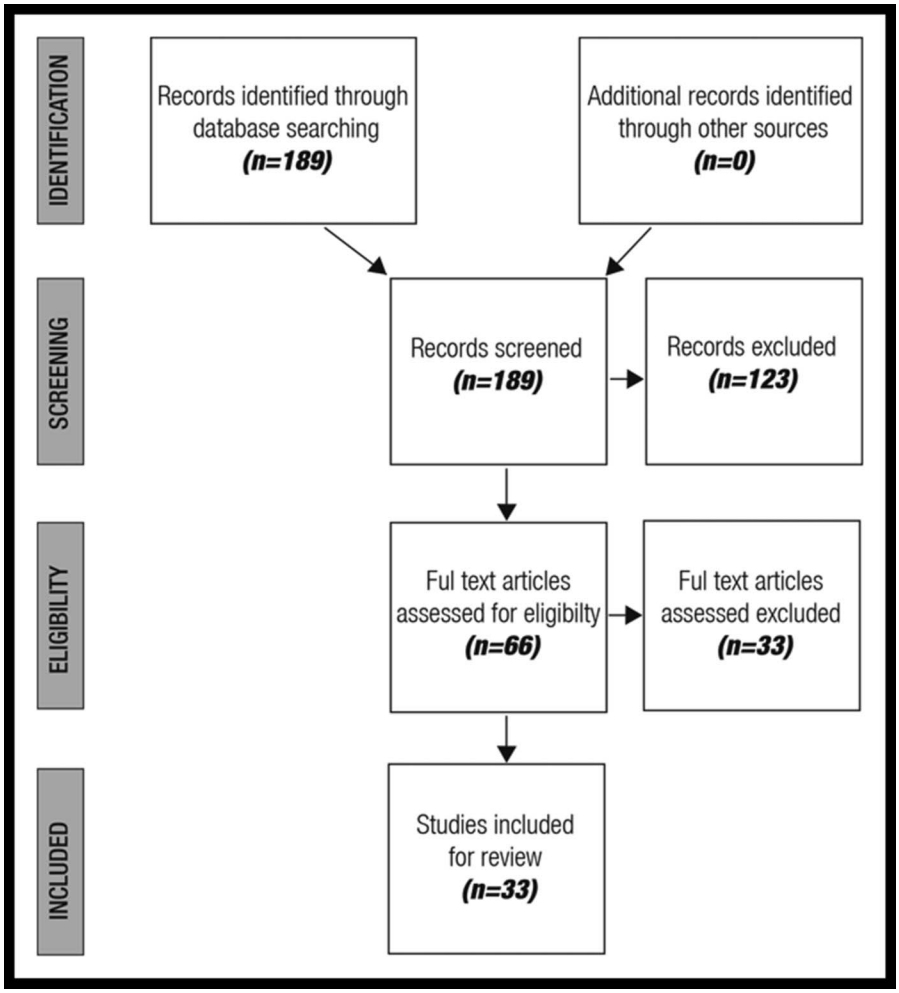

Fig. 1. Literature search strategy and number of included studies for review data collection.

does not allow a suppression of the microflora to a level compatible to health by mechanical means alone.[4,5]

According to Karring et al,[6] submucosal debridement alone utilizing an ultrasonic device or carbon fiber curette was not sufficient for the decontamination of the surfaces of implants with periimplant pockets of ≥5 mm and exposed implant threads. Thus, surgical treatment involving different mechanical, chemical, and laser-based decontamination protocols was suggested in combination to resective and/or augmentative approaches.

Recently, several randomized clinical trial (RCT)s have been conducted with the aim to unveil a hypothetic influence of the decontamination strategy on the outcomes from surgical treatment of periimplantitis. De Waal et al[7,8] employed an open-flap debridement using gauze soaked in sterile saline + bone recontouring + apical flap repositioning and compared 1 test (0.12% chlorhexidine [CHX] + 0.05% cetylpyridinium chloride) and 2 control (placebo solution or 2.0% CHX) measures for surface decontamination. At 12 months, although a substantial decrease in anaerobic bacterial load was observed on the implant surfaces treated with CHX, the test and both control procedures were associated with marked but comparable reductions in clinical parameters (mean bleeding on probing and pocket depth scores) in addition to similar radiographic bone loss. In the same vein, another 2 arm RCT applying the same protocol but substituting CHX by 35% phosphoric acid demonstrated the antimicrobial effectiveness of implant surface decontamination but failed to show any clinical difference in comparison to saline control.[9]

The assumption of a beneficial effect from surface decontamination has been also tested for open-flap surgical treatment through a number of retrospective, nonrandomized, prospective and RCTs. In particular, an RCT driven by Carcuac et al[10,11] failed to find any influence of chemical decontamination employing 0.2% CHX on 1- and 3-year-term success regardless of the implant surface. Although significantly decreased compared with baseline, bacterial load and composition of submucosal sample did not appear to be affected by CHX application on implant surface at 3, 6, and 12 months postsurgery. These findings are in line with a 5-year prospective study[12,13] investigating open-flap debridement with saline soaking as a method of chemical decontamination and highlight the favorable success rate that could be expected from this treatment strategy. When decontamination using plastic curettes in combination with implant surface treatment by 0.2% CHX was retrospectively compared with air-abrasive powder application on fixture during open-flap debridement of periimplantitis, no differences could be clinically observed between these procedures at 12-month time point.[14]

With regard to the surgical regenerative approach of periimplantitis, several decontamination techniques have been described. Isehed et al[15] reported that the application on fixture surface of enamel matrix derivates (EMD) combined with sodium chlorohydrate (9 mg/mL) favorably switched subgingival microbiota to Gram+ aerobic populations and was linked with an increase in bone level as compared with non-EMD controls. Another RCT conducted by Jepsen et al[16] could not, however, provide clinical evidence on the beneficial influence of titanium granules used for periimplant defect reconstruction following mechanical cleansing of fixture surface with titanium brushes and application of hydrogen peroxide. Only a gain in marginal bone level was observed. Other regenerative protocols include antibiotic-mixed allografts (tobramycin 50%, vancomycin

50%) subsequent to implantoplasty[17] or guided bone regeneration following EDTA (24%) and CHX (1%) chemical treatment of implant surfaces[18] reported by 2 case-series studies. Both showed, after 1 year, an improvement in periimplant pocket depths and resolution of inflammation with significant radiographic bone fill.

Overall, various modalities to surgically treat infected implants have been described and tested alone or in combination in human studies. The primary treatment goal must be to clean and disinfect the implant surface to render it biocompatible, thus permitting healing of the inflammatory lesion and reosseointegration.[4] Histological evidence of direct bone contact to previously contaminated implant has been previously demonstrated in animal settings following proper cleansing.[19] By contrast, human reosseointegration following periimplantitis surgical treatment has been only recently evidenced on implant surfaces mechanically treated with plastic curettes and chemically decontaminated with sodium chloride (0.25%) and hydroxen peroxide in conjunction with defect reconstruction using bone substitutes.[20] This demonstrates that reosseointegration is achievable with the condition of a proper decontamination approach for the surgical treatment of periimplantitis.

New innovative technologies like the use of lasers and new therapeutic approaches, such as photodynamic therapy, have shown the potential benefits the treatment of periimplantitis.[21–29] Because laser dentistry has been developed extensively in the past few years, there is a need for a comprehensive review to evaluate the efficacy of laser therapy and provide evidence in the treatment of periimplantitis.

CONCLUSIONS

Although the consensus report from the 8th European Workshop on Periodontology stated that "a proven method of decontaminating the implant surface"[30] is a critical component of surgical treatment, existent clinical, radiographic, and microbiological data do not favor any decontamination approaches and fails to show the influence of a particular decontamination protocol on surgical therapy. Further clinical investigations are needed to determine the superiority of a decontamination method if existing.

DISCLOSURE

The authors claim to have no financial interest, either directly or indirectly, in the products or information listed in the article.

ROLES/CONTRIBUTIONS BY AUTHORS

K. T. Koo: writing–original draft. F. Khoury: review, editing. K. P. Leander: review and editing. F. Schwarz: methodology, literature review, and screening. A. Ramanauskaite: investigation and journal screening. A. Sculean: review and editing. G. Romanos: corresponding author, review, editing, and project administration.

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