



Review

Efficacy of scaling and root planing with and without adjunct antimicrobial photodynamic therapy on the expression of cytokines in the gingival crevicular fluid of patients with periodontitis: A systematic review



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ABSTRACT

Background: The aim of the present review was to study the efficacy of scaling and root planing (SRP) with and without adjunct antibacterial photodynamic therapy (aPDT) on the expression of cytokines in the gingival crevicular fluid (GCF) of patients with periodontitis.

Methods: In order to address the focused question: “What is the efficacy of SRP with and without aPDT on the expression of cytokines in the GCF of patients with periodontitis” an electronic search without time or language restrictions was conducted up to and including July 2016 in indexed databases using various key words. The exclusion criteria included reviews, laboratory and experimental studies, case reports, commentaries, letters to the editor, interviews, updates, studies where intervention group received aPDT without previous SRP, and studies where local delivery of antibiotics was used as adjunctive therapy to aPDT.

Results: Six randomized control trials were included in the present systematic review. All studies included a control group which received only SRP. Results from 34% of studies reported lower cytokine levels among individuals receiving adjunct aPDT to SRP compared to patients receiving SRP alone. Selective cytokines reduction in the GCF following SRP with adjunct aPDT compared with SRP alone was reported in 50% of the studies. In one study SRP with adjunct aPDT failed to reduce GCF cytokine concentration.

Conclusion: From the literature reviewed the efficacy aPDT as adjunct to SRP in downregulating GCF cytokines remains debatable. Further well-designed studies are needed in this regard.

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1. Introduction

Periodontitis is an inflammatory disease that compromises the supporting and protective connective tissues of teeth such as gingiva, periodontal ligament, cementum and alveolar bone [1,2]. The most common microbes associated with the etiology of periodontitis include *Aggregatibacter actinomycetemcomitans*, *Fusobacterium nucleatum* and *Porphyromona gingivalis* [3]. Besides its classical clinical features (such as bleeding on probing [BOP], clinical attachment loss [CAL] and probing depth [PD] ≥ 4 mm) periodontitis also triggers a cascade of inflammatory events from an immunological aspect. This includes the increased formation and expression of destructive inflammatory cytokines (such as interleukin [IL]-1, tumor necrosis factor [TNF]- α , macrophage activator factor) in oral fluids (such as gingival crevicular fluid [GCF]) that enhance osteoclastic activity and impair bone formative capacity of osteoblasts. [4–6]. In an experimental study on Rhesus monkeys, Ebersole et al. [7] investigated the expression of cytokines associated with ligature-induced periodontitis (LiP). The results showed that the initiation and progression of LiP is characterized by up-regulation of T-helper (Th)17/T-regulatory cytokine genes (such as IL-1 β , IL-6 and transforming growth factor [TGF]- β) and down-regulation of Th1/Th2 cytokine genes (IL-18 and IL-25) in the gingival tissue [7]. Likewise, Toyman et al. [8] reported higher gingival crevicular fluid (GCF) IL-1 β , matrix metalloproteinase (MMP)-3 and tissue type plasminogen activator concentrations in patients with periodontal disease as compared to individuals with healthy periodontium. Furthermore, Ongoz Dede et al. [9] reported higher GCF IL-32 and TNF- α , and lower IL-10 levels among patients with periodontitis.

Traditionally, mechanical debridement (synonym scaling and root planing [SRP]) of teeth and root surfaces is performed for the treatment of periodontitis [10,11]. However, antimicrobial photodynamic therapy [aPDT] when performed as an adjunct to SRP has been reported to significantly improve the clinical periodontal status (by reducing BOP and PD) compared with SRP alone [12–14]. Moreover, following SRP with adjunct aPDT, a significant reduction in the expression of pro-inflammatory cytokines (such as IL-1 β , and MMP-8) in the GCF has also been reported among patients with periodontitis compared with SRP alone [15,16]. Luchesi et al. [17] reported a significant reduction in the expression of interferon [IFN]- γ , IL-6, IL-8 levels, and IL-1 β in the GCF of patients that received SRP with adjunct aPDT compared with those that received SRP alone. Similar results were reported by Souza et al. [18] and Queiroz et al. [16]. However, conflicting results have been also reported. Lui et al. [19] reported comparable GCF IL-1 β concentration among patients treated with adjunct aPDT and low level laser therapy to SRP and those patients treated with SRP alone. Likewise, Pourabbas et al. [20] reported similar levels of IL-1 β , MMP-8 and MMP-9 in GCF of patients treated with SRP with and without adjunct aPDT. In this regard, there is a controversy in indexed literature regarding the efficacy of SRP with adjunct aPDT in reducing

the expression of pro-inflammatory cytokines in the GCF of patients with periodontitis.

With this background, the aim of the present review was to study the efficacy of SRP with and without adjunct aPDT on the expression of cytokines in the GCF of patients with periodontitis.

2. Material and methods

2.1. Focused question

This systematic review was conducted by following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [21]. A specific question was developed according to the Participants, Interventions, Control, and Outcomes (PICO) format. The focused question was “What is the efficacy of SRP with and without aPDT on the expression of cytokines in the GCF of patients with periodontitis?”

2.2. Eligibility criteria

A study was considered eligible for inclusion if it met the following criteria: (a) randomized controlled clinical trials; (b) conducted in adult patients (> 18 years) diagnosed with chronic and/or aggressive periodontitis; (c) presence of control group (patients receiving SRP without adjunctive aPDT); (d) interventions evaluating efficacy of aPDT as adjunctive therapy to SRP; and (e) studies reporting one or more cytokine levels as outcome. The exclusion criteria included qualitative and/or quantitative reviews, laboratory (*in vitro*) and experimental (animal models) studies, case reports, commentaries, letters to the editor, interviews, updates, studies where intervention group received aPDT without previous SRP, and studies where local delivery of antibiotics was used as adjunctive therapy to aPDT.

2.3. Literature search protocol

The international database of Prospectively Registered Systematic Reviews in Health and Social Care (PROSPERO) and the Cochrane Register of Systematic Reviews were searched in July 2016, and presented no existing or current review protocols assessing the GCF cytokine profile among individuals with periodontitis treated with SRP compared to those individuals treated with adjunct aPDT to SRP. In order to identify studies relevant to the focused question, two authors (SVK and FJ) conducted a structured and logical electronic search without time or language restrictions up to and including July 2016 in PubMed (National Library of Medicine), Google-Scholar, Scopus, EMBASE, MEDLINE (OVID) and Web of Knowledge databases. The following Medical Subject Headings (MeSH) were used: (1) periodontal debridement, (2) periodontal diseases, (3) periodontitis, (4) photochemotherapy, and (5) cytokines. Other related non-MeSH terms were used in the search strategy to detect articles discussing periodontal parameters and periodontal treatment. These included: (6) non surgical periodontal therapy, (7) mechanical curettage, (8) photodynamic

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