

Antibiotics in periodontal treatment: an umbrella review

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Introduction

Periodontitis is a chronic inflammatory condition in which the dysbiosis of the subgingival microbiota plays a role¹. Antibiotic therapy in periodontology has been widely investigated over the years as a adjunct therapy that has been proposed as a supplement to standard periodontal treatments². A key challenge is determining whether, and in which cases, antibiotics will be beneficial, as there is still a lack of robust scientific evidence supporting their application. Furthermore, considering the estimated 23.6% prevalence of severe periodontitis among dentate people worldwide³ underscoring the need for judicious use of antibiotics to avoid unnecessary risks in potentially billions of people. This goes in line with the current “antimicrobial stewardship” principles, which advocate for the careful and responsible management of antimicrobials to ensure their effective, responsible and appropriate use⁴.

Aims

This umbrella review aimed to appraise the methodological quality and meta-analytical strength and validity of the evidence of systematic reviews (SRs) on systemic and local antibiotics in periodontal therapy.

Results

Forty-four SRs were included for quantitative and qualitative appraisal, consisting of 221 meta-analyses ^{2, 9-54}. Most SRs focused only on systemic antibiotics (72.1%), 11 on local antibiotics (18.0%) and 6 on both systemic and local antibiotics (9.8%). The overall methodological quality was low, with only four and two SRs of high or moderate quality, respectively.

Out of 221 meta-analyses, 69 indicated that the effect of systemic or local antibiotics was statistically not significant. Twenty-nine meta-analyses - ranging from suggestive to strong strength of evidence - derived from one high-quality and three low-quality SRs indicated that systemic or local antibiotics had a beneficial and statistically significant effect on periodontal health parameters, including average clinical attachment loss, bleeding on probing, and percentage of pocket closure. Of those, four strong evidence meta-analyses from a low quality systematic review indicated significant and meta-analytically robust but with negligible effect. About 65.5% of the meta-analyses with suggestive to strong evidence are unlikely to change with more future studies.

Materials & Methods

Following protocol registration (PROSPERO CRD42024527222), a comprehensive search was conducted up to March 2024 in PubMed (via MEDLINE), Web of Science, EMBASE, CENTRAL (Cochrane), and LILACS. Grey literature was retrieved via OpenGrey, and reference lists of included studies were manually screened. Two independent reviewers (J.B. and V.M.) conducted the search and selected studies based on: (1) systematic reviews with meta-analyses; (2) human studies; (3) assessment of systemic and/or local antibiotic use as an adjunct to periodontal therapy. Data were extracted using a predefined table by the same reviewers, with disagreements resolved by a third (P.L.). Inter-reviewer agreement was excellent (κ = 0.93; 95% CI: 0.89–0.97).

The methodological quality of SRs was judged using A MeaSurement Tool to Assess systematic Reviews ²⁵, classifying SRs as High (no/one minor weakness), Moderate (multiple minor weaknesses), Low (one major flaw ± minor weaknesses), or Critically Low (\geq 2 major flaws ± minor weaknesses). Meta-analyses were graded per established methodology ⁶, and evidence strength was categorized as strong, highly suggestive, suggestive, or weak ^{6,7}. We then integrated AMSTAR 2 ratings with meta-analytical strength into an 'Overall Grading' system: Strong – if strong meta-analytical estimates and high methodological quality according to AMSTAR 2; Highly Suggestive – if highly suggestive meta-analytical estimates and high methodological quality according to AMSTAR 2 or if strong metanalytical estimates and moderate methodological quality according to AMSTAR 2; Suggestive – if suggestive meta-analytical estimates and high methodological quality according to AMSTAR 2 or if highly suggestive meta-analytical estimates and moderate methodological quality according to AMSTAR 2; Weak - If the latter conditions were not verified, the meta-analysis was classified as weak evidence or if the SR is of low or very low quality.

Fail-safe number of Rosenberg explored the number of nonsignificant, unpublished, or missing studies that would be required to change the direction of that evidence⁸.

Discussion

Systemic antibiotics, whose meta-analysis combined multiple types, have been found to be supported by weak evidence. The efficacy of local antibiotics cannot be confidently recommended for clinical application. However, if future systematic reviews employ a high methodological standard, the overall strength of the meta-analytical findings is not expected to change according to fail-safe number statistics.

In SRs with meta-analyses on antibiotics for periodontal therapy, participant numbers per antibiotic type were often low, limiting the ability to draw definitive conclusions. To improve statistical power, data from different antibiotics were frequently pooled in a single meta-analysis. Notably, those categorized as suggestive to strong evidence often combined multiple antibiotic types. While this enhances robustness, it may obscure specific effects of individual antibiotics. To better clarify each antibiotic's role, more studies—especially longitudinal ones—focused on specific agents are needed. Local antibiotics offer targeted delivery with fewer systemic side effects, but their efficacy often appears lower than systemic regimens. Despite achieving high concentrations at infection sites, the limited number of high-quality studies hampers direct comparison. This highlights the need for more rigorous, comparative research to clarify the optimal use of local versus systemic antibiotics in periodontal therapy

The included SRs showed generally low methodological quality based on AMSTAR 2 ratings, with several notable deficiencies. These findings emphasize the need to strengthen methodological rigor and transparent reporting to improve the reliability of conclusions. Editorial processes should also support more rigorous review standards.

Many meta-analyses relied on average clinical values rather than clinically meaningful metrics, such as the percentage of sites meeting threshold improvements. Averages may mask individual patient outcomes by smoothing variability—e.g., modest mean gains in pocket depth or attachment may not reflect how many sites achieved significant recovery. This can mislead practitioners about true efficacy. Reporting threshold-based outcomes (e.g., % of sites with predefined clinical gains) offers a clearer view of treatment performance across patients and sites, enabling more accurate assessment and better-informed periodontal therapy decisions.

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