



# Limited Evidence Suggests Prophylactic Antibiotic Regimen May Reduce Dental Implant Failure

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**Original article being reviewed:**  
 Prophylactic antibiotic regimen and dental implant failure: A meta-analysis.  
 Chrcanovic BR, Albrektsson T, Wennerberg A.  
 J Oral Rehabil 2014;41:941–956.

## Background

This article critically appraises a systematic review that was conducted in 2014 to investigate the effects of prophylactic antibiotic regimen on implant failure rates and postoperative infection when performing dental implant treatment in healthy individuals.

## Clinical question

Does a prophylactic antibiotic regimen before implant placement in healthy patients have an effect on the prevention of implant failure and postoperative infection in comparison with those not receiving an antibiotic?

## Summary of methods and results

Manual, ongoing trials and electronic searches without time or language restrictions were conducted. Three authors independently screened titles and abstracts of the identified studies. Related data were extracted by the review authors. The risk of bias of the studies was assessed. Implant failure and postoperative infection were the outcomes measured. The meta-analysis revealed that use of antibiotic prophylaxis significantly affected the implant failure rates (relative risk [RR] of 0.55,  $P = .0002$ ). The number needed to treat (NNT) to prevent one patient having an implant failure was 50. There were no significant effects of prophylactic antibiotics on the occurrence of postoperative infections in healthy patients receiving implants ( $P = .520$ ).

## Critical appraisal

The results of this review should be interpreted with caution, as they include seven studies that were considered at high risk of bias with the presence of uncontrolled confounding factors.

## Practical implications

The use of prophylactic antibiotics may decrease the rate of implant failure, but care should be taken as the emergence of resistant pathogens may result from indiscriminate use of antibiotics in addition to potential adverse effects.

*Int J Evid Based Pract Dent Hygienist 2016;2:40–43. doi: 10.11607/ebh.26*

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## Evidence summary

### Background

Every effort, including a thorough and comprehensive patient examination and adherence to proper implant placement and loading protocols, should be done in order to increase the success rate of the dental implant. Prevention of dental implant failure is of great importance to both the patient and the dental professional. There are debates about the routine use of antibiotic prophylaxis and its role in preventing implant failure and infection in implant dentistry. Some studies have shown that the use

of prophylactic antibiotics before dental implant placement can reduce the rate of postoperative infection, and thus increases the success rates of osseointegration.<sup>1,2</sup> In contrast, other studies found no such effect.<sup>3,4</sup> Unfortunately, bacterial resistance to antibiotics has been on the rise<sup>5</sup> and there are potential complications of antibiotic use, including fatal allergic reactions, diarrhea, and, in some cases, pseudomembranous colitis.<sup>6</sup> Accordingly, dental professionals should exercise caution when prescribing antibiotics for healthy patients, weighing any potential benefits against any potential harm.

### **Clinical question**

Does a prophylactic antibiotic regimen before implant placement in healthy patients have an effect on the prevention of implant failure rate and postoperative infection in comparison with those not receiving an antibiotic?

### **Methods**

Electronic searches without time or language restrictions were undertaken in three databases. A manual search was also performed in numbers of dental implant-related journals. The reference lists of the identified studies and the relevant reviews on the subject were checked for possible additional studies. Moreover, a search was also done for ongoing clinical trials, and the reviewers contacted authors for possible missing data.

Three authors independently screened titles and abstracts of the identified studies. Disagreements, if found, were resolved by discussion. Excluded studies were recorded with the reasons for exclusion. Clinical human trials, either randomized or nonrandomized, that compared implant failure in any group of patients receiving prophylactic antibiotics vs those not receiving antibiotics before implant placement were included. In contrary case reports, in vitro and animal studies were excluded.

Related data were extracted by the review authors. The risk of bias of the studies was assessed using the Cochrane Collaboration tool.<sup>7</sup> Implant failure and postoperative infection were the dichotomous outcomes measured. Results were expressed using a random-effects model to evaluate the implant failure; the fixed-effects model was used when the postoperative infection outcomes were evaluated. The estimate of relative effect was expressed in risk ratio (RR) with a 95% confidence interval (CI). The number needed to

treat (NNT) was calculated and sensitivity analysis undertaken by the review authors to detect differences among the studies that showed a high risk of bias.

### **Results**

Fourteen eligible trials were included in this review (eight randomized controlled trials [RCTs], four controlled clinical trials, and two retrospective studies). Six studies were considered to have a low risk of bias, one study to have a moderate risk, and seven studies were considered to have a high risk of bias. Nine studies had short follow-ups ( $\leq 6$  months).

Of 8,603 dental implants placed in patients receiving antibiotics, 304 failed (a failure rate of 3.53%) and 396 of 6,269 dental implants failed in patients not receiving antibiotics (a failure rate of 6.32%).

Of 14 included studies, 8 recorded postoperative infection. The occurrences of postoperative infection were 25 in 1,000 patients receiving antibiotics (2.5%) and 29 in 770 patients not receiving antibiotics (3.8%).

The meta-analysis revealed that use of antibiotic prophylaxis significantly affected the implant failure rates (RR of 0.55; 95% CI 0.41–0.75;  $P = .0002$ ). The number needed to treat (NNT) to prevent one patient having an implant failure was 50 (95% CI 33–100). There were no apparent significant effects of prophylactic antibiotics on the occurrence of postoperative infections in healthy patients receiving implants ( $P = .520$ ).

### **Conclusions**

The authors concluded that there is evidence that suggests that a prophylactic antibiotic regimen significantly reduces failure of dental implants placed in ordinary conditions. However, there were no apparent significant effects of prophylactic antibiotics on the occurrence of postoperative infections in healthy patients receiving implants.

### **Critical appraisal**

AMSTAR was used for critically appraising this review and meta-analysis.<sup>8</sup>

### **Strengths**

The major strengths of this systematic review include the following: The reviewer performed a thorough and comprehensive search strategy with no time or



language restrictions, including databases, hand-searching, and contact with authors for possible missing data; patient-centered outcomes (implant failure and occurrence of postoperative infection) were assessed by the included studies, and clearly defined eligibility criteria were established; more than one reviewer screened titles and abstracts and extracted data; disagreements were resolved by discussion between the authors (however, they did not report measures of agreement for either eligibility or quality rating decisions); and the reasons for excluding studies were reported, and excluded studies are referenced. Potential publication bias for the studies was assessed using the funnel plot approach. A sensitivity analysis was also conducted by excluding the studies with high risk of bias.

### Weaknesses

A precise, well-structured PICO question, including the range of patients and interventions, was not provided by the reviewers. There is no indication that the gray (unpublished) literature was searched. The authors of this review reported that a study protocol did not exist, but protocol is essential for transparency and must be rigorously enforced to ensure that a review is done properly. It is advisable that the protocol is developed in the beginning before the review commences, and the authors must adhere to it as much as possible.<sup>9</sup> The scientific quality of the included studies was assessed according to the Cochrane Collaboration risk of bias assessment tool. This tool is very suitable for the RCTs; however, their use in quality assessment of nonrandomized controlled trials was not proper. It would have been better for the authors to use the Newcastle-Ottawa Scale (NOS) for that purpose.

Numerous confounding factors have affected the outcomes; for example, the patient's ages ranged from 18–86 years old, and some of the included patients were smokers. Investigators placed implants with different brands and surface treatment, and in some trials implants were placed into grafted sites. Follow-up periods varied from 4 months to 6 years, and postoperative antibiotics used in seven trials but not prescribed in seven other trials. All these confounding factors affect the treatment outcome.

In this review, low-quality studies (seven studies were considered at high risk of bias, and one study at moderate risk) with small sample size drastically decrease the level of evidence and recommendation. Although the meta-analysis revealed that use

of antibiotic prophylaxis significantly affected the implant failure rates, the number needed to treat (NNT) in order to prevent one implant failure was 50, which is fairly high for prevention of implant failures. The same topic of this review was also addressed by Esposito et al<sup>10</sup> in a 2013 Cochrane review. While this review included controlled trials and retrospective studies, the Cochrane review was typically restricted to RCTs. The conclusions of both reviews are similar in that antibiotics seem successful at reducing early failure of implants.

The Cochrane review concluded: "Scientific evidence suggests that, in general, antibiotics are beneficial for reducing failure of dental implants placed in ordinary conditions. Specifically 2 g or 3 g of amoxicillin given orally, as a single administration, 1 hour preoperatively significantly reduces failure of dental implants."<sup>10</sup>

With the increase in people seeking dental implant therapy, the use of prophylactic antibiotics may decrease the rate of early implant failure. Although the role of antibiotic prophylaxis in preventing infection subsequent to implant surgical procedures is well established,<sup>10</sup> care should be taken as the emergence of resistant pathogens may result from indiscriminate use of antibiotics in addition to increased costs and potential adverse effects. Thus, prophylactic antibiotics may be considered when there is significant risk of infection, either because of the characteristics of the procedure or because of the patient's local or systemic health condition. More studies with a larger sample size, longer follow-up, and consideration of possible confounding factors are needed to clarify the effect of prophylactic antibiotics on implant success.

### Acknowledgments

The author reports no conflicts of interest. The author would like to thank Dr Iman Radi, PhD, for her support during preparation of the manuscript.

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