Interventions for replacing missing teeth: Antibiotics in dental implant placement to prevent complications: Evidence summary of Cochrane review

Srinivasan Jayaraman

Department of Prosthodontics, Indira Gandhi Institute of Dental Sciences, Sri Balaji Vidyapeeth University, Puducherry, India

Abstract

The failure of dental implant can occurs at the preoperative planning stage, at the surgical stage, and at the postoperative stage. The success of this treatment can be increased if the clinical implant practice guidelines are prepared based on the recommendations from the highest level of research evidence (i.e.,) from systematic review of randomized controlled trials (RCTs) with meta-analysis. The Cochrane reviews of interventions are basically systematic reviews of RCTs with meta-analysis but follow a systematic methodological approach following the guidelines from Cochrane handbook for Systematic Reviews of Intervention. They give the current best evidence as they are updated every 2 years which is being the minimum period for an update. This evidence summary recommends the use of antibiotics, single dose of 2 g of amoxicillin 1 h prior to implant surgery to prevent implant failure, based on the body of evidence from the Cochrane review that was first published in 2003, 2008, and then updated twice in 2010 and 2013. The included studies are not from our population for the research question asked in this updated Cochrane review; hence, the need to do primary research in our population to support the available evidence is mandatory.

Key Words: Antibiotics, evidence summary, implant placement

Address for correspondence:
Dr. Srinivasan Jayaraman, Department of Prosthodontics, Indira Gandhi Institute of Dental Sciences, Sri Balaji Vidyapeeth University, Puducherry - 605 008, India. E-mail: Srini_rajee@yahoo.co.in

THE STRUCTURED PROCESS OF COCHRANE REVIEW

The Cochrane reviews help clinicians and policy makers take informed decisions based on the best available evidence at that point of time. The methodology followed is a well-planned structured approach based on the principles of the Cochrane handbook for Systematic Reviews of Intervention and guided by the managing editor and coordinating editors of that particular review group.[1] For oral health, it is the Cochrane Oral Health group currently based at the University of Manchester U.K.[2] To do a Cochrane review the title is registered with the oral health group, then the protocol is written and published which lays down the plan for the review and finally the review is written as per the protocol and published. The Revman is the

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software on which the review was done, and ARCHIE software is the Server for the Revman where the review is stored during preparation.

Each Cochrane review addresses an important clinical question (objective) based on the PICOT + studies (randomized controlled trial [RCT]) format, the literature search includes electronic, hand search, and gray literatures for all the studies addressing that particular research question - the search strategy is basically prepared by the trial search coordinator for that review group during protocol development, all studies are independently reviewed for included studies by two independent authors based on inclusion and exclusion criteria and arbitrated by the third (teamwork) when in doubt. The data are extracted in the a priori data extraction form prepared at the protocol stage and is fed into the Revman software including all the studies which helps to assess the risk of bias for every included study (internal validity of every study is assessed as six domains from handbook for low, high unclear risk of bias for each domain) and meta-analysis is performed for each outcome to get the pooled estimate when more than two studies are present (analyzed for heterogeneity-sensitivity) in Revman. The data in Revman from the risk of bias and the meta-analysis data are exported and imported into the GRADE pro software.

All outcomes are downgraded in the RCT based on the quality of evidence (internal and external validity) after analysis in the GRADE pro software using GRADE approach and finally the summary of finding table (SOF) is prepared based on the quality of evidence using GRADE approach are presented for the primary outcomes. The final review includes all finding along with the SOF table both grading the quality of evidence as low, moderate, high quality, and presenting the pooled estimate along with assumed and corresponding risk/odds for low and high risk population for the intervention in the final review. They give the current best evidence as they are updated every 2 years, which is being the minimum period for an update.

CLINICAL QUESTION?

This Cochrane review addresses a relevant clinical question to reduce the risk of dental implant and the prosthetic failure after implant placement. To assess the beneficial or harmful effect of systemic prophylactic antibiotic, at dental implant placement versus no antibiotic or placebo and if antibiotic is beneficial, to determine which type, dosage, and duration are most effective?[3] The question when split on the PICOT + studies format, The Population = People requiring implant placement, Intervention = prophylactic antibiotic, type, dose, and duration. Comparison = No antibiotic or placebo, Outcome-implant

complications (implant failure, prosthetic failure, postoperative infection, adverse events to drugs), Time Points-not applicable here, the studies assessed were only RCTs.

SUMMARY OF AVAILABLE EVIDENCE-FROM FOUR INTERVENTIONS

The failure of a dental implant can occur at the preoperative planning stage, at the surgical stage, and at the postoperative stage.[4] The complications due to infection, during implant placement, can be reduced by following proper sterilization protocol and decreasing the duration of the surgery. If deviation to the planned surgical protocol is encountered due to poor preoperative planning, it may prolong the surgery increasing the likelihood of bacterial contamination from the oral environment. Earlier the role of antibiotics to decrease complication has been refuted in the dental literature.[5] The role of antibiotics was limited to medically compromised patients in surgery. The contradicting results of various RCTs and retrospective studies have not given a clear, standardized antibiotic regimen to follow on the type, dose, and duration of the antibiotics to be used during and after implant placement. The success of any treatment can be increased if the clinical practice guidelines are prepared based on the recommendation from the highest level of research evidence (i.e.,) from a systematic review of RCTs with meta-analysis. This Cochrane review tries to address this critical issue so that standard guidelines (for the use of antibiotics at implant placement) can be developed for the future.

This Cochrane review was first published in 2003, 2008, and then updated twice in 2010, and 2013 included only RCTs with more than 3 months follow-up based on the preset inclusion and exclusion criteria. Only six RCT met the criteria and were included after searching till June 2013. Data extraction and assessment of the risk of bias were done in Revman. Three studies had a high risk of bias, and three studies had a low risk of bias, the latter three studies contributed more to the results giving more credibility to the evidence. The unit of analysis was participants and not implants for this study. This review addressed four interventions (1) Antibiotics verse no antibiotic or placebo intervention; meta-analysis was performed for all four outcomes [Table 1]. (2) For intervention comparing antibiotic prophylaxis for the different duration of same drug only one trial with 100 participants (comparing different dose and duration - four-armed trial) was available - so no meta-analysis was performed. (3) For intervention comparing different type of antibiotic no RCTs were available, so no meta-analysis was performed; and (4) For intervention comparing different dosage, no RCT was found so no meta-analyses were performed.

Table 1: Available evidence for preoperative antibiotic versus placebo or no antibiotic for implant placement to prevent implant complications and adverse events

Objective (intervention-outcomes)	Number of included studies	Independent variable (experimental-control groups)	Dependent variable-outcomes	Risk of bias in studies (internal validity)	Heterogeneity	Overall weighted-pooled effect estimate from meta-analysis	GRADE-approach for quality of evidence	Available evidence
Antibiotics versus placebo or no antibiotic	Implant failures 6	Antibiotic versus no antibiotics or placebo	Implant failure	Three studies - Esposito 2008a, Anitua 2009, Esposito 2010a, low-risk of bias, other 3 studies had high-risk of bias	None as I^2 value was less	Risk ratio 0.33 (0.16–0.67) at 95% CI*	Moderate quality	Good evidence The risk reduction for developing implant failure is 67% and may be as low as 33% and as high as 84% The NNTB to prevent implant failure is 25 persons from the baseline risk of control which is very significant clinically
Antibiotics versus placebo or no antibiotic - prosthetic failures	5	Antibiotic versus no antibiotics or placebo	Prosthetic failure - four studies contributed to this event	Three studies - Esposito 2008a, Anitua 2009, Esposito 2010a, low-risk of bias, other 2 studies had high-risk of bias	None as I^2 value was less	Risk ratio 0.44 (0.19–0.1.00) at 95% CI		Evidence not conclusive even though the overall pooled estimate favor antibiotics the lower limit of the CI touches the line of no difference
Antibiotics versus placebo or no antibiotic - postoperative infection	6	Antibiotic versus no antibiotics or placebo	Postoperative infections- five studies contributed to this event	Three studies - Esposito 2008a, Anitua 2009, Esposito 2010a, low-risk of bias, other 3 studies had high-risk of bias	None as I^2 value was less	Risk ratio 0.69 (0.36–0.135) at 95% CI		No evidence found to prove that preoperative antibiotics reduced postoperative infections
Antibiotics versus placebo or no anti biotic - adverse events to antibiotics	6	Antibiotic versus no antibiotics or placebo	Adverse events to antibiotics	One studies - Esposito 2008a reported minor adverse events to antibiotics				No evidence found as only one study reported this outcome in all six studies

CI: Confidence interval, NNTB: Number need to treat for one additional benefit

CLINICAL PRACTICE RECOMMENDATIONS

This Cochrane review gives good evidence for the use of prophylactic antibiotic prior to implant placement. The prophylactic regimen suggested is a single dose of 2 g of amoxicillin 1 h preoperatively. The Amoxicillin can reduce the risk of developing implant failure by 67% and it could be as low as 33% and as high as 84% compared to not using antibiotics. The Number Need to Treat for one additional Benefit (NNTB) to prevent implant failure is 25 persons from the base line risk of control, which is very significant clinically. It gives inconclusive evidence that prosthetic complication will be reduced. It infers poor evidence for the postoperative infection and adverse events. It also concludes that there is no evidence to state the most effective antibiotic to be used, it's dosage and duration of use due to lack of clinical trials.

FUTURE RESEARCH RECOMMENDATIONS

Large pragmatic-double blinded trials comparing single versus prolonged use are to be conducted. The RCTs are also needed to address the following interventions, different types of antibiotic regiment verses no antibiotic or placebo. The different dose of same antibiotics and its dosage as these review did not find more than one RCT addressing this intervention. The outcomes to be seen are implant failure, prosthetic failure, postoperative infection, and adverse events. The included studies are not from our population for the research question asked in this updated Cochrane review, hence, the primary research must focus on these interventions and outcomes in our population to develop clinical practice guidelines.

Conflict of interest

There are no conflict of interest.

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