ORIGINAL ARTICLE

EVALUATION OF THE NEED FOR ANTIBIOTIC PROPHYLAXIS DURING ROUTINE INTRA-ALVEOLAR DENTAL EXTRACTIONS IN HEALTHY PATIENTS: A RANDOMIZED DOUBLE-BLIND CONTROLLED TRIAL

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KEYWORDS
Antibiotic misuse, Antibiotics, Dental extraction

Source of Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of Interest: The authors have no actual or potential conflicts of interest.

Received 12 January 2017; revised 20 April 2017; accepted 20 April 2017

J Evid Base Dent Pract 2017: [184-189]

1532-3382/$36.00

doi: http://dx.doi.org/10.1016/j.jebdp.2017.04.007

ABSTRACT

Objective

The aim of this randomized double-blind controlled trial was to evaluate the role of antibiotics in the perioperative period of dental extractions in healthy patients.

Methods

The study population included patients visiting the outpatient department of our institute. Four hundred patients were selected and randomly divided into 4 groups and underwent routine dental extraction. In group A, patients were prescribed only anti-inflammatory drugs in the postoperative period. In group B, patients were prescribed antibiotics for 3 days and concomitant anti-inflammatory drugs in the postoperative period only. In group C, patients were prescribed a single dose of antibiotic 1 hour before the extraction procedure with no postoperative antibiotics, and only anti-inflammatory drugs were prescribed in the postoperative period. In group D, patients were prescribed mouthwash starting 15 minutes before the procedure and continuing twice daily for a period of 7 days along with anti-inflammatory drugs in the postoperative period. Patients were asked to follow up on the seventh postoperative day for suture removal and were evaluated for pain, swelling, dry socket, and local signs of infection. The study was approved by the Internal Ethics Review Committee of the institute.

Results

No significant differences were seen among the groups with respect to pain (χ^2 [1, N = 171] = 4.939, P = .552), swelling (χ^2 [1, N = 171] = 10.048, P = .347), or postextraction complications.

Conclusions

Prophylactic antibiotics are not required during routine dental extractions in healthy patients. The use of antibiotic therapy without appropriate indications can result in the development of resistant organisms. However, a clear trend is seen in which practitioners overprescribe antibiotics as well as medications in general. The current evidence questions the benefits of prophylactic antibiotic therapy for patients undergoing dental extractions. In our opinion, there is no justification for routine antibiotic prophylaxis for dental extractions in healthy patients.

INTRODUCTION

For the past century, antibiotic therapy has played a significant role in the treatment of infectious diseases. Ever since the discovery of penicillin by Fleming, the world has benefited from the use of these agents, making antibiotic use one of the greatest advances in medical history.

Along with the benefits of antibiotics, there has also been an explosion in the number of bacteria that have become resistant to these drugs. The problem is not the antibiotics but the way these drugs are used. The overuse of antibiotics has produced a crisis as bacterial mutations develop resistant strains.

In the United States, dentists alone prescribed 24.5 million courses of antibiotics in 2013, with a rate of 77.5 prescriptions per 1000 people.[1] Worldwide, dental prescribing increased by 62.2%, and its proportionate contribution increased from 6.7% to 11.3% among all community prescriptions of antimicrobials. The rate of prescribing increased the most for dental patients aged 60 years or older.[2]

In India, about 180,000 dentists serve over 1 billion people.[3] Nearly 300 dental schools graduate almost 20,000 dentists each year; hence, they play an extremely influential role in the overprescribing of antibiotics and concomitant antibiotic resistance.

Tooth extraction is usually done by general dental practitioners. An estimated 17% of all patients undergo extractions over a 5-year period,[4] with the highest tooth extraction rate per patient seen among patients in the sixth and seventh decades of life.[5] The reasons for tooth extraction are usually caries and periodontal disease.

In 2010, a systematic review by Costelloe et al. showed that both long-duration and multiple courses of antibiotics prescribed in general dental practice were consistently associated with the development of resistance to those antibiotics in that individual. In addition, the greater the number of antibiotics prescribed, the higher the chance of resistant bacteria development.[6]

According to the European Commission, overuse and misuse of antibiotics are the main causes of antibiotic resistance. For this reason, the following study has been conducted using various regimens during the preoperative, perioperative, and postoperative periods of simple extractions in our institute. The objective of this study was to evaluate the need for antibiotic prophylaxis in healthy patients undergoing tooth extraction to determine the most appropriate use.

Aims and Objectives

The aim of this randomized double-blind controlled trial was to evaluate the role of antibiotics in the perioperative period of dental extractions in healthy patients.

Objectives

The objectives of this study were to evaluate the role of preoperative and postoperative antibiotics in routine dental extractions and to evaluate the role of chlorhexidine mouthwash in dental extractions.

MATERIALS AND METHODS

This was a randomized double-blind clinical study conducted in the Department of Oral & Maxillofacial Surgery in our institute from June 2015 to August 2015. The study was approved by the Internal Ethics Review Committee of the institute.

Selection Criteria

Patients who required the extraction of teeth because of caries and for periodontal reasons were selected randomly from the outpatient department. The selection focused on patients of both sexes, aged 16 to 80 years, who were to undergo intra-alveolar dental extractions under local anesthesia with adrenaline. For patients younger than 18 years, consent was obtained from the parent or guardian.

Patients with known allergy to lignocaine, immunocompromised patients (human immunodeficiency virus, leukemia, radiation, and so on), patients with diabetes mellitus, patients taking oral contraceptives, pregnant and lactating women, smokers, any patients with cellulitis or space infection, or those presenting systemic signs of infection such as fever were excluded from the study. Third molar extractions and intra-alveolar extraction converting to surgical extraction were also excluded from the study.

Sample Size

A sample size of 200 was calculated with $P < .05$ as significant and power of study at 80%. A dropout rate of 50% was estimated, and the sample size was determined to be 400.

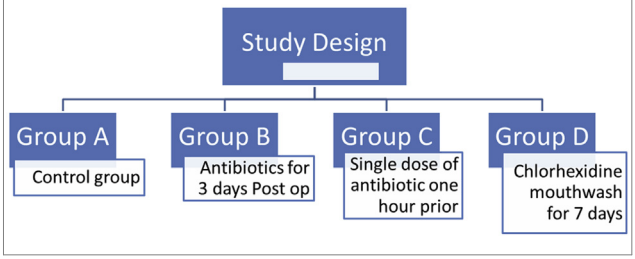
Method

A detailed case history and informed consent were obtained from the patient to participate in our study regarding the use of antibiotics in dental extractions.

Patients were randomly divided into 4 groups (Figure 1) as follows:

- Group A: patients were prescribed only anti-inflammatory drugs in the postoperative period (control group).
- Group B: patients were prescribed antibiotics for 3 days and concomitant anti-inflammatory drugs in the postoperative period only.
- Group C: patients were prescribed a single dose of antibiotic 1 hour before the extraction procedure with no postoperative antibiotics. Only anti-inflammatory drugs were prescribed in the postoperative period.

Figure 1. Study design.



- Group D: patients were prescribed mouthwash starting 15 minutes before the procedure and continuing twice daily for a period of 7 days along with anti-inflammatory drugs in the postoperative period.

The randomization process was carried out using the CONSORT statement 2010 checklist for randomized controlled clinical trials. Participants were allocated to one of the 4 groups by asking them to pick one of the sequentially numbered, opaque, sealed envelopes. Each participant had an equal chance of being assigned to any 1 of the 4 groups. The randomization was conducted by the second author throughout the course of the study.

The antibiotic used as a standard for group B patients was amoxicillin 500 mg orally thrice daily for 3 days. A single oral dose of amoxicillin 500 mg was used for group C 1 hour before the extraction procedure. The oral flora contains gram-positive bacteria; hence, a beta-lactam antibiotic was prescribed.[7]

The anti-inflammatory drug used as a standard for all patients was ibuprofen 400 mg up to a maximum of thrice daily as long as the pain persisted. It was chosen because of its high safety index and adequate pain control.[8]

The extraction was performed under 2% lignocaine with adrenaline.

To evaluate the healing process, pain, swelling, dry socket, local signs of infection, and discomfort after extraction among the groups, it was imperative that the patient return for evaluation after a week. In an effort to improve patient compliance and to ensure all the cases were evaluated, a single suture was placed after the extraction, and patients were asked to follow up on the seventh postoperative day for suture removal. All patients were asked to report earlier than 7 days if they developed any complications.

The follow-up was done by blinded interviewers who were interns of the same institute posted in the department.

The following data were collected:

- The presence or absence of pain; its intensity, if present, was evaluated using the Visual Analogue Scale.
- The presence or absence of swelling; its severity, if present, was evaluated as mild, moderate, or severe based on the evaluator's interpretation.
- The presence or absence of local signs of infection such as pus, sinus tracts, and space infection.
- Any history of fever.
- The presence of dry socket if found during the clinical evaluation.

Parameters

Pain

	No pain (VAS = 0)	Mild to moderate pain (VAS = 1-5)	Moderate to severe pain (VAS = 6-10)
Attribute	0	1	2

Swelling

	No swelling	Mild swelling	Moderate swelling	Severe swelling
Attribute	0	1	2	3

Statistical Evaluation

The data were tabulated and analyzed using SPSS 17.0 software. The level of significance was set at 5%, and it was decided that all p values less than 0.05 would be treated as significant. The level of significance was tested using the chi-square test. All the data were presented in the form of charts and graphs using descriptive statistics.

RESULTS

Of the 400 patients, 229 were excluded because of loss to follow-up. Hence, a total of 171 patients were included in the study.

Group A

Of the 47 participants in group A, 57.4% returned with no pain, and the remaining 42.6% had mild pain and

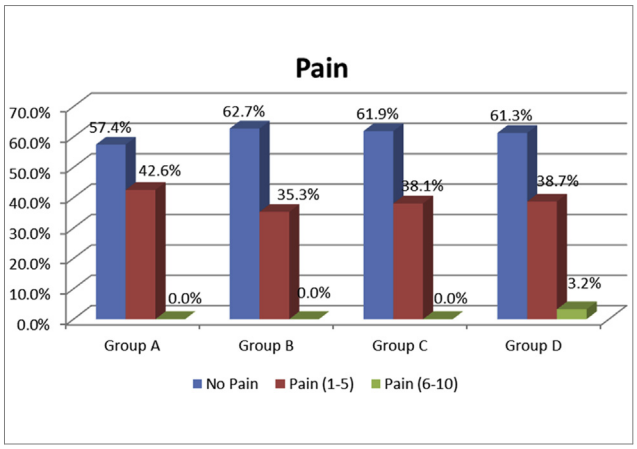
discomfort (Visual Analogue Scale = 1-5). Mild swelling was noted in a few patients (14.89%), and no swelling was observed in others. None of the patients in this group developed other complications such as fever, dry socket, pus, or a sinus tract.

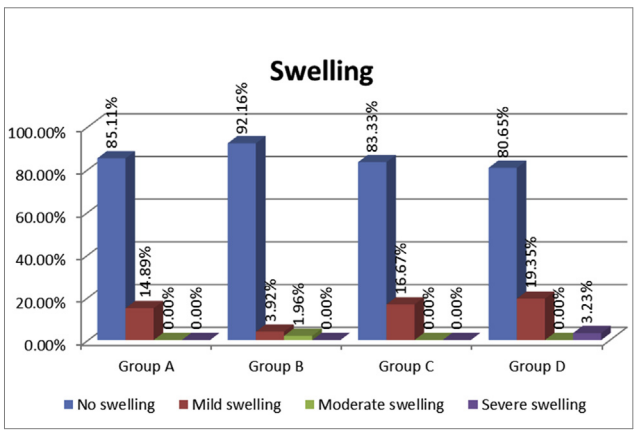
Group B

Of the 50 participants in group B, 62.7% experienced no pain, whereas 35.3% complained of only mild pain. No swelling was seen in 92.16% of the patients. Only 2 patients complained of mild swelling, whereas 1 patient had moderate swelling and was evaluated early because of it.

Group C

Of the 42 patients in group C, the majority experienced no pain (61.9%) or mild discomfort (38.1%). No swelling was





reported similarly in most (83.33%) of the patients and mild swelling developed in just a few (16.67%). None of the patients reported other signs of infection.

Group D

Of the 32 patients in group D, just 1 patient developed severe pain and dry socket. The rest had no pain (61.3%) or only mild pain (38.7%). Swelling was similar to that seen in the other groups, with 80.65% showing no evidence of swelling and 19.35% having mild swelling. Apart from the 1 patient with dry socket, no other patient reported any sign of local or systemic infection. No significant differences were seen in the occurrence of pain and swelling among the groups as determined by the chi-square test: for pain, χ^2 (1, N = 171) = 4.939, P = .552 or for swelling, χ^2 (1, N = 171) = 10.048, P = .347.

DISCUSSION

The use of antibiotic therapy without appropriate indications can result in adverse outcomes. Health care practitioners tend to overprescribe antibiotics and other medications in general. Some of the risks associated with indiscriminate antibiotic therapy are the development of resistant organisms, secondary infection, antibiotic toxicity, and the development of allergic reactions. An estimated 6%-7% of patients receiving antibiotics experience some kind of adverse reaction.

As correctly pointed out by Murali et al.,[9] antibiotics are often used as "drugs of fear" used to "cover" errors of omission or commission and thereby "prevent" claims of negligence. Approximately half of all antibiotics used in hospitals are for patients without signs or symptoms of infection and, in many cases, are used to prevent infections or to ensure that "all was done" to avoid later criticism.

The advances in antibiotic therapy are being countervailed by the fast emergence of resistant strains of microorganisms resulting from the indiscriminate use of antibiotics over the past 50 years. There has been a logarithmic rise in the prevalence of penicillin-resistant organisms in the past decade, making it difficult to select the optimum therapy for patients.[10]

Most dentists prescribe antibiotics after extraction based on the assumption that the healing will be uneventful, patients will not complain of pain, and recall visits can be minimized. However, recent studies show that antibiotics are not needed for routine extractions.[11]

Although the use of antibiotics is common after tooth extraction, this practice may not adhere to the principles of antibiotic prophylaxis. Peterson[12] has delineated these principles:

1. The surgical procedure should have a significant risk of infection.
2. The correct antibiotic for the surgical procedure should be selected.
3. The antibiotic level must be high.
4. Antibiotic administration time should be correct.
5. The shortest effective antibiotic exposure is chosen.

Hence, to justify the use of antibiotics in regular dental extractions, principle 1 must be proved, that is, whether there is a significant risk of infection in normal intra-alveolar extractions. Termine et al.[13] reviewed the available scientific evidence regarding antibiotic prophylaxis in dentistry among both healthy subjects and medically compromised patients and concluded that antibiotic prophylaxis is advisable only in a small percentage of patients who have a risk of severe infective complications (ie, infective endocarditis and prosthetic joint infection, septicemia in severely immunocompromised patients, bisphosphonate-related osteonecrosis of the jaw). Thus little or no scientific evidence exists for antibiotic prophylaxis in subjects with other systemic diseases and in healthy individuals.

An extensive review by Lodi et al.[14] included 18 double-blind placebo-controlled trials with a total of 2456 participants. According to this review, antibiotics did reduce the risk of infection in patients undergoing third molar extraction(s) by approximately 70% (RR, 0.29 [95% confidence interval: 0.16-0.50]; $P < .0001$, 1523 participants, moderate quality evidence) when compared with placebo, which means that infection is prevented in 1 person for every 12 to 17 patients given antibiotic prophylaxis. Some evidence indicates that antibiotics may reduce the risk of dry socket by 38%, and some indicates that patients who have prophylactic antibiotics may have less pain overall 7 days after the extraction compared with those receiving placebo, which may be a direct result of the lower risk of infection. However, no evidence shows a statistically significant difference between antibiotics and placebo with respect to the outcomes of fever, swelling, or trismus 7 days after tooth extraction. Antibiotics are associated with an increase in generally mild and transient adverse effects compared with placebo. For every 21 people (range: 8-200) who receive antibiotics, an adverse effect is likely.

This comprehensive and excellent review concluded that although general dentists perform dental extractions because of severe dental caries or periodontal infection, no trials evaluated the role of antibiotic prophylaxis in this group of patients and in this setting. Some evidence shows that prophylactic antibiotics reduce the risk of infection, dry socket, and pain after third molar extraction and result in an increase in mild and transient adverse effects.

It is unclear whether the evidence in this review can be generalized to those with concomitant illnesses or immunodeficiency or those undergoing the extraction of teeth due to severe caries or periodontitis. However, patients at a higher risk of infection are more likely to benefit from prophylactic antibiotics because infections in this group are likely to be more frequent, associated with complications, and more difficult to treat. Owing to the increasing prevalence of bacteria that are resistant to treatment with currently available antibiotics, clinicians should consider carefully whether treating 12 healthy patients with antibiotics to prevent 1 infection is likely to do more harm than good.

Regarding the use of chlorhexidine mouthwash for the prevention of alveolitis, Tomas et al.[15] performed a randomized controlled trial in which chlorhexidine significantly reduced bacteremia when given before and after dental extraction compared with the control group. Many other studies have demonstrated the effectiveness of chlorhexidine in preventing dry socket and postoperative infection.

A meta-analysis by Minguez-Serra et al.[16] discussed the different doses and concentrations of chlorhexidine mouthwash and concluded that 0.2% chlorhexidine gel before extraction and twice a day after extraction for 7 days seems to have the best efficacy in reducing dry socket. No significant benefit associated with the use of mouthwash was observed in our study.

In our study, no statistically significant difference was found among the groups that received antibiotics and the control group. This is in accordance with the currently available scientific literature, although most studies were done on third molars and not on routine dental extractions.

The authors accept that the subjective nature of the evaluation criteria may give rise to some interexaminer variability. However, because the examiners were all trained at the same institute, this variability was minimized. The Fleiss' kappa value calculated to determine the agreement between raters was $k = 0.613$, which indicated substantial agreement.[17] An effort was made to reduce interviewer bias by blinding of the examiners during follow-up.

Loss of data due to dropout may bring about systematic error in the results. However, the usual cause for a patient not following up is resolution of symptoms. Hence, assuming most people who did not follow up had few or no symptoms, we believe our objectives remain valid.

CONCLUSION

Antibiotics continue to be prescribed by dentists as much as or more than in the past despite the scarcity of clinical trials demonstrating their need. Old habits and beliefs die hard, and there is considerable social and medicolegal pressure on dentists to prescribe antibiotics. Dentists want their patients to get well and want to prevent unpleasant complications. These desires, coupled with the belief that many oral problems can lead to infection, stimulate the prescribing of antibiotics.

The issue regarding the role of prophylactic antibiotic therapy in routine dental extractions is highly controversial. The current evidence questions the benefits of prophylactic

antibiotic therapy for patients undergoing dental extractions. In our opinion, there is no justification for routine antibiotic prophylaxis for dental extractions in healthy patients.

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