

Prophylactic antibiotics in intra-oral bone grafting procedures: a prospective, randomized, double-blind clinical trial

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Abstract (J Korean Assoc Oral Maxillofac Surg 2012;38:90-5)

Objectives: This study was conducted in order to assess the efficacy of 1st generation cephalosporin as use as a single-dose preoperative prophylactic antibiotic for surgical wound infections resulting from intra-oral bone grafting procedures.

Materials and Methods: A total of 23 patients who were to undergo intra-oral bone graft procedures participated in this study. After randomization, 2 grams of 1st generation cephalosporin was orally administered to both the experimental and placebo groups one hour prior to surgery in a double-blind fashion. Post-operatively, the experimental group (12 patients) was orally administered placebo three times a day for three days. The control group (11 patients) was orally administered 1st generation cephalosporin three times a day for three days. The postoperative course was observed for one month including the clinical parameters associated with infection.

Results: Postoperative infections were noted in 1 out of 11 patients in the experimental group. No infections occurred in the control group.

Conclusion: There was no significant difference in the incidence of postoperative infections between the two groups. Two grams of 1st generation cephalosporin administered orally one hour before surgery served as an effective prophylactic antibiotics therapy for intra-oral bone graft surgery.

Key words: Intra-oral bone graft, Prophylactic antibiotics, Surgical site infection

[paper submitted 2011. 10. 28 / revised 2012. 2. 13 / accepted 2012. 4. 4]

I. Introduction

Recently, bone graft for anatomical places where placing an implant is difficult has increased due to the increase of dental implant surgery. To improve the success rate of bone graft, preventing infection in the surgical site is important. Surgical site infection (SSI) is the second or third most popular infection among all hospital infections. It increases not only the period and cost of treatment with complications such as bone resorption caused by local infection in bone graft sites but also the time of hospitalization and medical

expenses due to overall infection, which lead to increase in the morbidity rate and death rate. Prophylactic antibiotics treatment is a method that injects antibiotics before or after surgery when a wound is infected by germs; it is used widely in oral maxillofacial surgery and general dental treatment¹.

Though the use of prophylactic antibiotics is increasing, surgeons currently tend to rely on their experience rather than definite grounds because there is no specific standard for the term and dosage of antibiotics in oral maxillofacial surgery and general dental treatment. In addition, antibiotics prescribed imprudently to increase the success rate of implant for old patients with systemic diseases have caused problems such as increase of antimicrobial resistance and cost of antibiotics.

Therefore, this study examined the effects of prophylactic antibiotics by dosage to establish guidelines for antibiotics for each disease and treatment used in general dental treatment and oral maxillofacial surgery with a review of literature.

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*This study was conducted as a project for the Korea Center for Disease Control and Prevention (project name: application of prophylactic antibiotics in surgery and development of proper use, No. 56).

II. Materials and Methods

1. Design

This study is a randomized, prospective, double-blinded clinical test for bone graft patients. To evaluate the clinical effects of the duration of antibiotics treatment after surgery, the group without prophylactic antibiotics was compared with the group injected with them three times a day for three days. The study passed the deliberation of the Institutional Review Board prior to being conducted. The method was reported to IRB of Seoul National University Dental Hospital and approved (IRB No.: CME10001), and it complied with the regulation.

2. Patients

The subjects of this study were patients who visited Seoul National University Dental Hospital to have bone graft for guided tissue regeneration and dental implant or to have bone graft in the alveolar bone or for the defect of maxillary bone due to cystoma, etc. The following patients were excluded: 1) those with a specific systemic disease; 2) those treated with antibiotics before the surgery or whose body temperature was increasing continuously (body temperature measured at an ear was higher than 38°C); 3) those with hypersensitive reaction to antibiotics; 4) those with fever or evidence of infection at the surgery; 5) those determined as ineligible by the doctor, or; 6) those who did not agree to participate in the clinical test.

3. Methods

Patients were randomly divided into the experimental group (placebo group) and control group (antibiotics group) using the block randomization method; double-blind trial using capsules in the same shape was conducted to prevent patients from recognizing the type of capsules. All bone graft surgeries were performed in the outpatients operating room under topical anesthesia. Two g of 1st-generation cephalosporin was administered orally 1 hour before surgery to all patients. After surgery, 1 g of capsule was administered orally to the experimental and control groups three times a day for three days. To the experimental group, capsules of starch-like antibiotics were administered as placebo after surgery. The control group was administered antibiotics. After surgery, other antibiotics were prohibited unless there

was infective complication (fever, infection of the surgical site, and respiratory organs). Ear temperature, general blood test (number of white blood cells, neutrophils, lymphocyte, and monocyte), erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP) were measured before the surgery. The next day, the existence of pain, edema, wound dehiscence, wound bleeding, and infection were examined, and general blood test (number of white blood cells, neutrophils, lymphocyte, and monocyte), ESR, and CRP were measured. Afterward, in the 1st, 2nd and 4th weeks, the presence of pain, edema, wound dehiscence, wound bleeding, and infection were examined. Edema and pain were examined with visual analog scale (VAS, 0-10); wound dehiscence, wound bleeding, and drainage of pus were examined and recorded by a tester. Based on the standards of SSI by Center for Disease Control and Prevention (CDC), postoperative wound infection was determined when drainage of surgical wound or natural wound dehiscence combined with excessive swelling, pain, and fever in the surgical wound was identified².

4. Statistical analysis

Test data were analyzed with mixed repeated ANOVA using a statistics program (SPSS version 19.0; SPSS Inc., Chicago, IL, USA). The standard of statistical significance was *P*-value less than 0.05.

III. Results

A total of 23 patients participated. Using the block

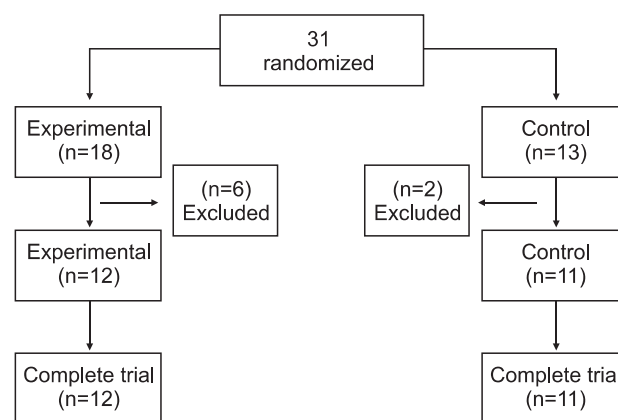


Fig. 1. Structure of the study population.

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randomization method, patients were divided into the experimental group (12 patients) without prophylactic antibiotics and the control group (11 patients) administered prophylactic antibiotics for three days.(Fig. 1) The average age of patients in the experimental group was 40.4 years; 5

were male and 7 were female.

The average age of patients in the control group was 56.3 years; 8 were male and 3 were female.(Table 1) In the experimental group, 1 patient (8.3%) had postoperative wound infection (Fig. 2) and pus was generated in the surgical site. After drainage of pus, however, the patient was cured. In the control group, no postoperative wound infection was observed. Neither was there significant difference in the incidence of infections between the two groups. With respect to ear temperature, though it changed significantly in the control group over time, there was no significant difference

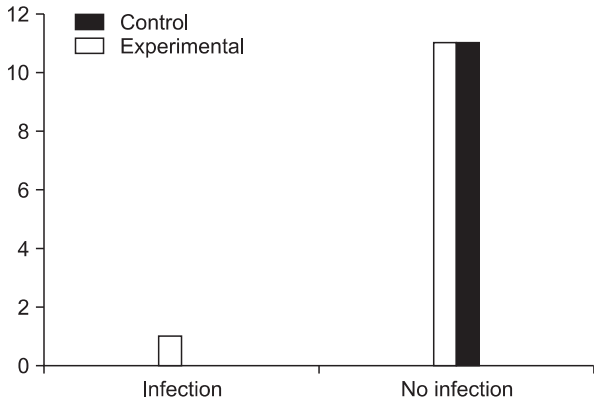


Fig. 2. Number of patients and infections at the receptor site. Jung-Woo Lee et al: Prophylactic antibiotics in intra-oral bone grafting procedures: a prospective, randomized, double-blind clinical trial. J Korean Assoc Oral Maxillofac Surg 2012

Table 1. Demographic characteristics of the study groups

Group	Total number of patients	Treatment	Gender	Mean age
Control	11	Antibiotics	M=8, F=3	56.3
Experimental	12	Placebo	M=5, F=7	40.4

(M: male, F: female)

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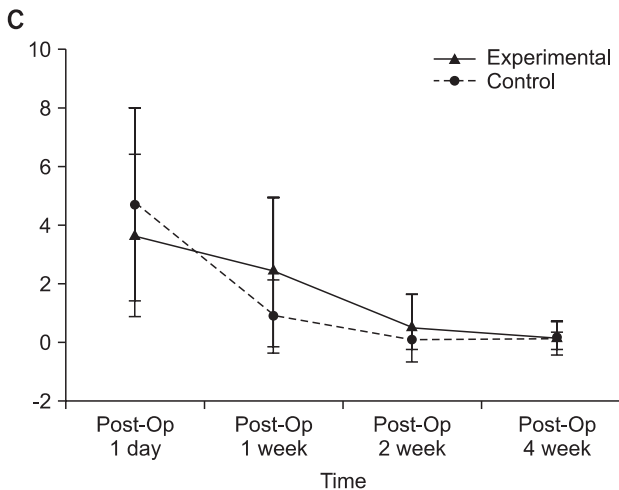
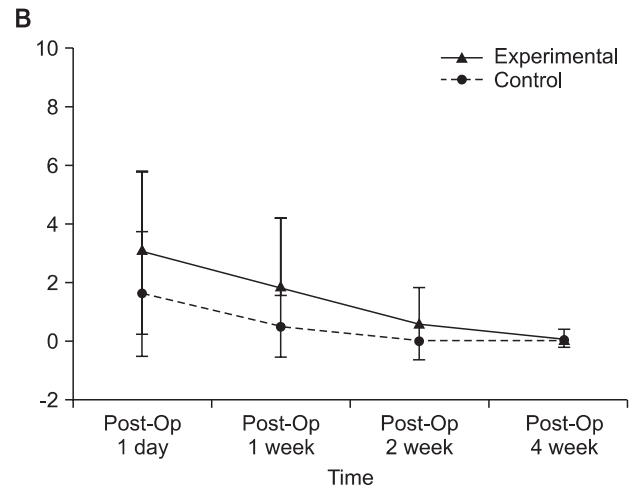
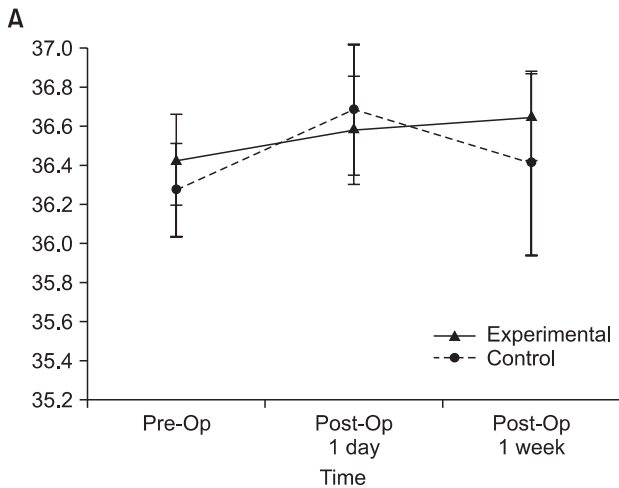


Fig. 3. Clinical parameters. A. Body temperature (°C). B. Pain (VAS: 0-10, 0 means pain-free state.). C. Swelling (VAS: 0-10, 0 means swelling-free state. There were no significant difference between experiment and control.

(Pre-op: preoperative day, Post-Op 1 day: postoperative day 1, Post-Op 1, 2, 4 week: postoperative 1, 2, 4 week)

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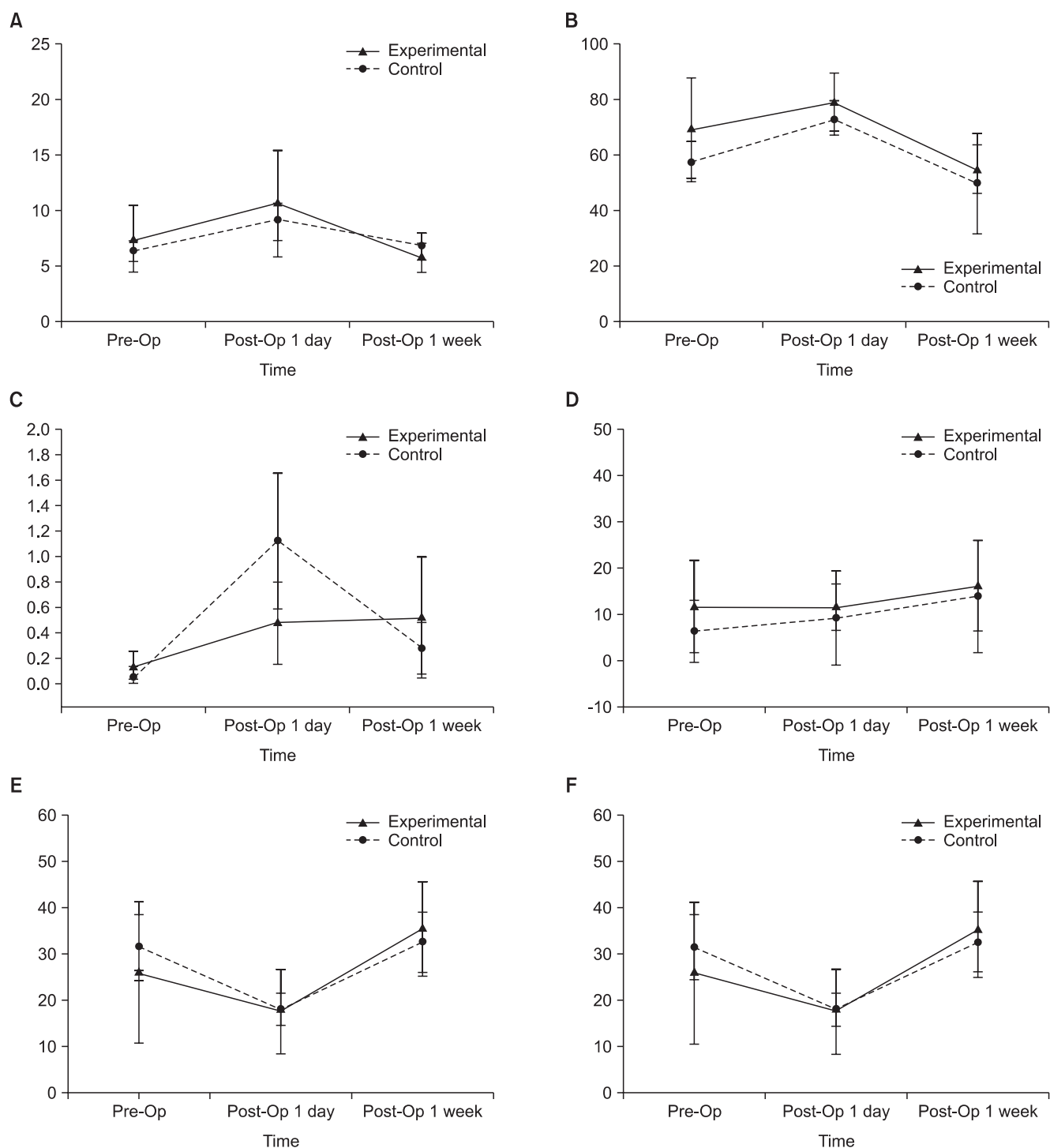


Fig. 4. Laboratory parameters. A. White blood cell count ($\times 100/\mu\text{L}$). B. Absolute neutrophil count ($\times 100/\mu\text{L}$). C. C-reactive protein (mg/dL). D. Erythrocyte sedimentation rate (mm/hr). E. Lymphocyte ($\times 100/\mu\text{L}$). F. Monocyte ($\times 10/\mu\text{L}$). There was no significant difference between the experimental group and control group. (Pre-Op: preoperative day, Post-Op 1 day: postoperative day 1, Post-Op 1 week: postoperative 1 week)

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between the two groups. Moreover, there was no significant difference between the two groups in terms of pain, swelling, general blood test (number of white blood cells, neutrophils, lymphocyte, and monocyte), ESR and CRP.(Figs. 3, 4)

IV. Discussion

The purpose of prophylactic antibiotics is to reduce medical expenses by preventing infection and decreasing the rate

of infection after surgery. Therefore, the ideal prophylactic antibiotics should apply to the most powerful germs that can infect wounds and should maintain proper concentration in the incision until it heals. It must be safe and should be applied on a short-term basis to minimize complication, resistance, and cost³.

Prophylactic antibiotics are used in dental surgery for 2 reasons: first is to prevent systemic infections, and second is to prevent local infections. Most of the research studies on the use of antibiotics to prevent systemic infections are conducted by other countries. Currently, the use of antibiotics to prevent systemic infections is generally carried out according to the guideline of the American Heart Association⁴. When prescribing antibiotics for this reason, doctors must decide whether antibiotics must be used according to the guideline of the American Heart Association. In addition, there is a need to determine the use of antibiotics based on close cooperation with the physician of the patient⁵.

According to Alrashdan et al.⁶, the guideline for the use of antibiotics is required especially for antibiotics to prevent local infections; the prescription of antibiotics considering the necessity, time of use, and dosage differs by the operator.

Prophylactic antibiotics are also necessary when the patient is highly likely to have postoperative wound infection or if the surgery will cause tissue trauma. In this case, it is more effective to apply the antibiotics before the surgery than after^{7,8}. According to the American Heart Association, the use of prophylactic antibiotics to prevent local infections is required for the extraction of the mandibular third molar, fracture operation, orthognathic surgery, and implant surgery. Recently, the use of prophylactic antibiotics has increased due to the increase of dental implant and related bone graft^{7,9}. In the case of bone graft in particular, infection means failure of the treatment; accurate guideline for prophylactic antibiotics is required, but related research studies are insufficient. Due to insufficient research studies and absence of a guideline, many clinicians tend to use antibiotics based on their experience. To prevent the increase of antimicrobial resistance, limiting the prescription of antibiotics is important because imprudent use of antibiotics is a major cause of increased antimicrobial resistance. Although the frequency and dosage of antibiotics are lower in the dental department than other medical departments, the imprudent use of antibiotics is still a serious problem. When necessary, antibiotics should be prescribed at the minimum level^{8,10}.

Literature of other countries with regard to the use of prophylactic antibiotics in bone graft reported no significant

difference in infection rate by type of prophylactic antibiotics (2 g penicillin group and 600 mg clindamycin) in the case of autogenous bone graft¹¹, and that prophylactic antibiotics did not change the infection rate¹². Note, however, that those research studies examined the graft results of only autogenous bone, not xenograft or synthetic bone.

To establish the guideline for resolving disputes on bone graft, this study examined the use of the most popular postoperative antibiotics. Prophylactic antibiotics were administered to both groups 1 hour before bone graft. It is important to maintain the necessary concentration of antibiotics in the body before incision to prevent post-surgical infection, which directly leads to graft failure. The group to which antibiotics were administered for 3 days after surgery showed no infection, whereas 1 postoperative infection was observed in the other group. There was no significant difference, however. In the control group, body temperature increased significantly right after surgery, but there was no significant difference between the two groups. This means prophylactic antibiotics did not have any effect. Pain and swelling decreased right after surgery, but there was no significant difference. Neither was there significant difference in the general blood test (number of white blood cells, neutrophils, lymphocyte, and monocyte), ESR and CRP. In the experimental group, 3 patients had wound dehiscence. However, there was no such occurrence in the control group. All cases of wound dehiscence in the experimental group were smaller than 5 mm and were cured naturally without infection regardless of the administration of prophylactic antibiotics.

V. Conclusion

In this study, there was no significant difference in the incidence of wound infection after bone graft with the injection of antibiotics. This can be a guideline for minimizing the imprudent use of antibiotics to resolve the problem of current abuse and misuse of antibiotics.

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