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The Efficacy of Postoperative Prophylactic Antibiotics in Orthognathic Surgery: A Prospective Study in Le Fort I Osteotomy and Bilateral Intraoral Vertical Ramus Osteotomy

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Purpose: This study examined the efficacy of the postoperative prophylactic antibiotics used in orthognathic surgery. The prevalence of surgical site infections (SSIs) was determined according to the use of postoperative prophylactic antibiotics. **Patients and Methods:** Fifty-six patients were divided into 2 groups. Each patient intravenously received 1.0 g of a third-generation cephalosporin (Cefpiramide) 30 minutes before surgery. Among them, 28 patients in the control group received 1.0 g Cefpiramide twice daily until the third day after surgery. The postoperative wounds were examined regularly for the presence of infectious signs. **Results:** There was no significant difference in the incidence of postoperative wound infections between patients who had received postoperative prophylactic antibiotic administration and those who had not ($p = 0.639$). **Conclusion:** Prolonged prophylactic antibiotic use after orthognathic surgery may not be necessary, provided that there are no other significant factors for wound infections.

Key Words: Orthognathic surgery, prophylactic antibiotics, surgical site infection

INTRODUCTION

Antibiotics are used to treat and prevent postoperative infections. In 1960, it was reported that pathogens are present during surgery[1,2] regardless of how aseptic the surgery might appear. Moreover, the correlation between prophylactic antibiotics and postoperative wound infections was demonstrated. Therefore, prophylactic antibiotics are now used in almost all surgical procedures. The most effective method of antibiotic prophylaxis is the preoperative administration of antibiotics because it can act at the time when the wound is potentially contaminated by bacteria.[2-4] On the other hand, it was also reported that the use of antibiotics after 3 - 4 hours of a bacterial invasion is unsuitable.[5]

Prophylactic antibiotics are generally administered both preoperatively and postoperatively. Hence, the effects of the indiscriminate method and period of administration are unclear, considering the multiple factors that contribute to postoperative wound infections.[6-8]

The use of antibiotic prophylaxis is controversial even in orthognathic surgery, which is a representative procedure for oral and maxillofacial surgery. There are reports show no increase in the incidence of infection without the administration of postoperative prophylactic antibiotics.[9,10] On the other hand, there are reports to suggest the necessity of continuous antibiotic administration.[11] However, orthognathic surgery is mainly performed on young patients without a specific medical history. Moreover, the number of factors associated with the development of postoperative wound infections decreases as the procedure becomes more generalized and its technique advances.

The aims of this clinical study were to evaluate the prevalence of postoperative wound infections with or without antibiotic prophylaxis after orthognathic surgery in young patients without any

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specific medical history, and to identify criteria for appropriate use of prophylactic antibiotics in orthognathic surgery.

PATIENTS AND METHODS

Fifty-six patients in their 20s without a specific medical history, and who were to undergo orthognathic surgical procedures at the department of oral and maxillofacial surgery at the dental hospital of Yonsei University were enrolled in this study. A horizontal maxillary osteotomy and vertical ramus mandibular osteotomy were performed by the same oral surgeon with the aid of trained nurses and residents under hypotensive general anesthesia. No bone grafts were performed. The duration of surgery was less than 5 hours. During surgery, maxillomandibular fixation was placed using steel wires, and drainage tubes were placed on both sides of the mandible. The drainage tubes were removed 2 days after surgery. The wires used for maxillomandibular fixation were removed and the sutures were taken out from the wounds 7 days after surgery. The patients received a non-steroid anti-inflammatory drug (Ketorolac trometamine 30 mg) intramuscularly immediately after surgery and every 6 hours until the next day. Compression bandages and ice packs were applied to the facial area until the second day after surgery.

The 56 patients were divided into 2 groups according to the randomization codes generated by Microsoft Excel: an experimental and control group. The patients in the experimental group received only 1.0 g of a third-generation cephalosporin (Cefpiramide) intravenously 30 minutes before surgery and did not receive the placebo. The control group also received 1.0 g of Cefpiramide 30 minutes before surgery as well as twice daily until 3 days after surgery. The patients were evaluated every day during the first 3 days and at the end of the 1st and 2nd week after surgery for any postoperative infections in reference to the criteria for defining a surgical site infection (SSI), recommended by the Centers for Disease Control and Prevention (CDC).[12] Postoperative wound infection was defined by at least 1 of the following criteria:

1. Purulent drainage from the surgical site with or without laboratory confirmation.
2. At least 1 of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness or heat, and a superficial incision deliberately opened by surgeon, unless the incision is culture-negative.
3. An abscess or other evidence of infection is found on a direct examination, during reoperation, or by the histopathological or radiologic examination.
4. Diagnosis of SSI by the surgeon or attending physician.

Statistical analysis was performed using a χ^2-test on the Statistical Package for the Social Sciences (SPSS for windows, ver. 12.0, SPSS Inc., Chicago, IL, USA). The study protocol was approved by the Institutional Review Board of the College of Dentistry, Yonsei University (YUDC).

RESULTS

The mean (SD) age of the experimental group was 23.9 years (5.84) with male-female ratio of 4 : 3. The average duration of surgery was 3 hours and 40 minutes. The mean (SD) age of the control group was 24.3 years (6.33) with male-female ratio of 1 : 1. The average duration of surgery was 3 hours and 55 minutes.

There were 3 infections in the experimental group and 2 infections in the control group, observed 2 weeks after surgery (Table 1). One patient in the experimental group was diagnosed with an infection by facial swelling, redness and sinus haziness in the waters' view, and the other 4 patients were diagnosed with a postoperative infection by swelling and redness, and pain on the mandibular area. Therefore, the wounds were opened by a surgeon and the patients were treated with antibiotics. However, only 1 patient in the control group developed wound dehiscence only without any drainage, fever, or swelling in the maxillary area. According to the χ^2-test, there was no significant difference in the prevalence of postoperative wound infections between the patients who had received postoperative prophylactic antibiotic administration and those who had not ($p = 0.639$).

Table 1. Results according to the Postoperative Antibiotic Prophylaxis

	Experimental group without postoperative antibiotics (n = 28)	Control group with postoperative antibiotics for 3 days (n = 28)
Age (Mean ± SD)	23.9 ± 5.84 yrs	24.3 ± 6.33 yrs
Sex (Male : Female)	16 : 12	14 : 14
Postoperative infection (n)	3	2
Wound dehiscence (n)	0	1

DISCUSSION

The method of antibiotic prophylaxis is determined by an evaluation of the patient, procedure, and surgical wound. The preoperative and immediate postoperative administration of antibiotics is a method generally used for antibiotic prophylaxis in almost all surgical procedures. However, antibiotics are continuously used postoperatively in most procedures because it is difficult to assess the factors associated with postoperative wound infections or appropriate antibiotic prophylaxis method.

On the other hand, orthognathic surgery is mainly performed on young patients without an underlying illness or comorbidity. Moreover, the number of factors affecting the development of postoperative wound infections decreases with the improvement of the surgical instruments, materials, techniques, and more generalized procedure.

Peterson[13] suggested that the prophylactic antibiotic administration for postoperative wound infections in oral and maxillofacial surgery should be performed if there is a strong probability of infection, and appropriate antibiotics must be given in high-dose but for only a short period of time. Orthognathic surgeries are classified as clean contaminated procedures with postoperative wound infection of 10% to 15%, and Peterson[13] reported that an incidence of an anticipated infection in oral clean contaminated surgery could be reduced by using prophylactic antibiotics. Zijderveld et al.[14] suggested that the incidence of postoperative infections (52.6%) increased without the administration of prophylactic antibiotics. Martis and Karabouta[9] suggested that the routine use of prophylactic antibiotics in orthognathic surgery is unnecessary, and Lindeboom et al.[15] also suggested that the use of postoperative prophylactic antibiotics (clindamycin) is unnecessary in orthognathic surgery (SSRO). Furthermore, Fridrich et al.[16] and Baqain et al.[17] suggested that the long-term use of antibiotics does not decrease the frequency of postoperative infections. However, wide range of patient's age, small group size, and various osteomies may cause difficulties when precisely evaluating the efficacy of prophylactic antibiotics.

Therefore, this study was undertaken to examine the prevalence of postoperative wound infections in young patients after orthognathic surgery (Le Fort I osteotomy and bilateral intraoral vertical ramus osteotomy) with or without the use of postoperative prophylactic antibiotics. Twenty eight patients were enrolled in each group. The samples were selected at a significance level of $\alpha = 0.05$ and a test power $\beta = 0.20$. A smaller infection rate was set to 5%, and the difference in the estimated infection rate was set to 30%, based on previous report that the incidence of postoperative wound infection using prophylactic antibiotics, ranges from 5.6% to 33.4%.[17] In this study, wound infections were observed in both groups, however, the number was small. This was attributed to the followings: the patients were young without a specific medical history, patients had no preoperative wound infections, no bone graft had been performed during surgery, the surgical procedures such as IVRO were less traumatic with a short duration, the tissue trauma during surgery was minimal due to the systematization of orthognathic surgery and the improvement of techniques, and wound control such as postoperative blood or exudate was properly performed.

The types of antibiotics used are important factors to consider for prophylactic antibiotic treatment. Penicillin is the representative antibiotic used as a prophylaxis during intraoral surgery and for the primary treatment of dental infections. Spaey et al[18] suggested the use of amoxicillin-clavulanate along with drain usage during SSRO in a study of antibiotic administration. In this study, third-generation cephalosporin antibiotics were administered before surgery, which is believed to be a possible prophylactic antibiotic that may be used in orthognathic surgery because most bacteria cultured during a dental infection are susceptible to third-generation cephalosporin.[19] There has been an increase in infections due to anaerobic and Gram-negative organisms,[20] and most wound infections after orthognathic surgery are caused by Gram negative bacteria.[21]

If a post-operative wound infection occurs despite the effective prophylactic antibiotic administration before surgery, it could be concluded that the bacteria in the infected wound are not sensitive to the prophylactic antibiotics administered, and in such cases, an appropriate antimicrobial therapy should be determined by a culture test of the bacteria found in the infected region.[21,22]

Prophylactic antibiotics reduce the risk of postoperative wound infections, which leads to a lower number of hospitalization days, reduced cost, and improved social life. However, the long-term use of postoperative prophylactic antibiotics may lead to several problems, such as various allergic reactions, increased cost, changes in resident bacterial colony *in vivo*, or appearance of resistant bacteria.[7,23]

More studies with much larger numbers of patients are needed on the administration of prophylactic antibiotics during orthognathic surgery and other oral and maxillofacial procedures. In addition, further research on properly appropriated use of antibiotic prophylaxis is warranted in order to minimize the use of prophylactic antibiotics and their adverse effects and problems. In the present study, there was no significant difference in the prevalence of postoperative wound infections between patients who had received postoperative prophylactic antibiotic administration and those who did not. Therefore, prolonged prophylactic antibiotic use after orthognathic surgery may not be necessary, provided that there are no other significant factors for wound infections.

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