RESEARCH PAPER

Impact Of Pre-Operative Antibiotic Use On Infection Rates After Major Oral And Maxillofacial Surgeries: A Retrospective Study.

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ABSTRACT

Background:Postoperative infections remain a significant complication following major oral and maxillofacial surgeries. The oral cavity contains a diverse microbial flora that may contaminate surgical sites during procedures, potentially leading to surgical site infections (SSIs). Pre-operative antibiotic prophylaxis is commonly used to reduce bacterial contamination and minimize postoperative complications. However, the routine use of antibiotics remains controversial due to concerns regarding antimicrobial resistance and inconsistent evidence regarding their effectiveness.

Aim:This study aimed to evaluate the impact of pre-operative antibiotic use on postoperative infection rates in patients undergoing major oral and maxillofacial surgeries.

Methodology:A retrospective study was conducted on 100 patients who underwent major oral and maxillofacial surgical procedures at a tertiary care dental hospital. Patients were divided into two groups: Group A (n=50) received pre-operative antibiotics, while Group B (n=50) did not receive pre-operative antibiotics. Data including patient demographics, type of surgery, duration of surgery, and postoperative infection outcomes were collected from medical records. Statistical analysis was performed using SPSS software, and the Chi-square test was used to determine the association between antibiotic use and infection rates. A p-value < 0.05 was considered statistically significant.

Results:Postoperative infection was observed in 4 patients (8%) in the antibiotic group and 10 patients (20%) in the non-antibiotic group. Although infection rates were lower among patients who received pre-operative antibiotics, the difference was not statistically significant ($\chi^2 = 3.03$, $p = 0.081$). Additionally, surgeries lasting more than two hours showed a higher infection rate compared to shorter procedures.

Conclusion:Pre-operative antibiotics were associated with a lower incidence of postoperative infections, but the difference was not statistically significant. Antibiotic prophylaxis should be considered based on individual patient risk factors and surgical complexity rather than routine use..

Keywords: Pre-operative antibiotics, Oral and maxillofacial surgery, Surgical site infection, Antibiotic prophylaxis, Postoperative complications

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INTRODUCTION

Major oral and maxillofacial surgeries are routinely performed to manage a wide range of conditions involving the facial skeleton, oral cavity, and associated soft tissues. These procedures include orthognathic surgery, tumor resection, trauma management, reconstructive surgeries, and complex dentoalveolar interventions [1]. Although these procedures are essential for restoring function, esthetics, and quality of life, they are associated with a potential risk of postoperative infections. Surgical site infections (SSIs) remain one of the most common complications following oral and maxillofacial procedures and can significantly affect patient recovery, treatment outcomes, and healthcare costs. Therefore, prevention of postoperative infections is a critical component of surgical planning and patient management in oral and maxillofacial surgery [2].

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The oral cavity harbors a diverse microbiological environment composed of numerous aerobic and anaerobic microorganisms. During surgical procedures involving mucosal incisions, bone manipulation, or implant placement, these microorganisms may enter the surgical site and potentially lead to postoperative infection [3]. Factors such as prolonged surgical duration, extensive tissue manipulation, patient systemic conditions, poor oral hygiene, and contamination of the surgical field can further increase the risk of infection [4]. As a result, clinicians have long considered the use of antibiotics as a preventive strategy to reduce the microbial load and minimize the likelihood of postoperative complications.

Pre-operative antibiotic prophylaxis is commonly administered in oral and maxillofacial surgeries with the aim of preventing bacterial contamination during surgery [5]. The principle behind antibiotic prophylaxis is to achieve an adequate concentration of the antimicrobial agent in the tissues and bloodstream at the time of surgical incision, thereby inhibiting the growth and spread of microorganisms introduced during the procedure. Various antibiotics, including penicillins, cephalosporins, and combinations such as amoxicillin-clavulanic acid, are frequently used for this purpose. When administered appropriately, antibiotic prophylaxis has the potential to reduce postoperative infection rates and improve surgical outcomes [6].

Despite its widespread use, the effectiveness and necessity of pre-operative antibiotics in all types of oral and maxillofacial surgeries remain a topic of ongoing debate. Some studies suggest that prophylactic antibiotics significantly reduce the incidence of postoperative infections, particularly in complex procedures involving bone grafts, implants, or long surgical durations [7]. Conversely, other studies report minimal or no significant difference in infection rates between patients who receive pre-operative antibiotics and those who do not. This inconsistency in findings has raised questions regarding the routine use of antibiotic prophylaxis, especially in procedures where the infection risk is relatively low [8].

Another important concern associated with indiscriminate antibiotic use is the growing problem of antimicrobial resistance. Overuse and inappropriate prescription of antibiotics contribute to the development of resistant bacterial strains, which poses a significant global public health challenge. In addition, unnecessary antibiotic administration may lead to adverse drug reactions, allergic responses, gastrointestinal disturbances, and increased healthcare costs [9]. Therefore, careful evaluation of the indications for antibiotic prophylaxis is necessary to balance the benefits of infection prevention with the risks associated with antibiotic overuse [10].

Clinical guidelines have attempted to address this issue by recommending antibiotic prophylaxis only in specific situations where the risk of infection or its consequences is high. For instance, prophylactic antibiotics are often recommended for immunocompromised patients, individuals with systemic diseases that impair healing, or procedures involving contaminated surgical fields [11]. However, variations in surgical techniques, patient characteristics, and institutional protocols often lead to differences in antibiotic prescribing practices among surgeons. This variability highlights the need for further evidence to support standardized guidelines regarding the use of pre-operative antibiotics in oral and maxillofacial surgery [12].

Retrospective studies provide valuable insights into real-world clinical practices and outcomes by analyzing previously recorded patient data [13]. Such studies can help identify patterns of antibiotic use, assess postoperative infection rates, and evaluate the relationship between antibiotic prophylaxis and surgical outcomes. By examining patient records over a defined period, researchers can determine whether the administration of pre-operative antibiotics has a significant impact on reducing postoperative infections in major oral and maxillofacial surgeries [14].

Furthermore, understanding the effectiveness of pre-operative antibiotic use is essential for improving patient safety and promoting responsible antibiotic stewardship. Evidence-based recommendations can assist clinicians in making informed decisions regarding antibiotic administration, ultimately reducing unnecessary prescriptions while maintaining optimal surgical outcomes [15]. Identifying whether pre-operative antibiotics truly influence infection rates will also help in developing standardized treatment protocols and improving overall surgical care.

Given the potential benefits and risks associated with antibiotic prophylaxis, it is important to critically evaluate its role in preventing postoperative infections following major oral and maxillofacial procedures. Therefore, this study is important to determine the impact of pre-operative antibiotic use on infection rates after major oral and maxillofacial surgeries.

Methodology

Study Design and Setting

This retrospective observational study was conducted to evaluate the impact of pre-operative antibiotic use on infection rates following major oral and maxillofacial surgeries. The study was carried out in the Department of Oral and Maxillofacial Surgery at a tertiary care dental hospital. Patient records over a defined study period of two years were reviewed to collect relevant clinical data. Ethical approval for the study was obtained from the Institutional Ethics Committee prior to data collection, and patient confidentiality was strictly maintained throughout the study.

Study Sample

A total of **100 patients** who underwent major oral and maxillofacial surgical procedures during the study period were included in the analysis. Patients were selected using a **convenience sampling method** from hospital records. The sample consisted of individuals who had undergone procedures such as orthognathic surgery, mandibular or maxillary fracture fixation, cyst or tumor enucleation, bone grafting, and other major maxillofacial surgical interventions requiring intraoral or extraoral access.

Inclusion Criteria

Patients were included in the study if they met the following criteria:
Patients aged **18 years and above**.
Patients who underwent **major oral and maxillofacial surgical procedures** under local or general anesthesia.
Patients with **complete clinical records**, including details of antibiotic administration and postoperative follow-up.
Patients who had **postoperative follow-up records for at least two weeks** to assess the occurrence of surgical site infection.

Exclusion Criteria

The following patients were excluded from the study:
Patients with **incomplete or missing medical records**.
Patients with **pre-existing infections at the surgical site** prior to surgery.
Patients who were **immunocompromised**, including those with uncontrolled diabetes, HIV infection, or undergoing chemotherapy.
Patients who were already receiving **long-term antibiotic therapy for other systemic conditions**.

Group Allocation

The selected 100 patients were divided into **two groups based on the administration of pre-operative antibiotics**:
Group A (Antibiotic Group): 50 patients who received pre-operative antibiotics prior to surgery.
Group B (Non-Antibiotic Group): 50 patients who did not receive pre-operative antibiotics.
Pre-operative antibiotics, when administered, typically included **amoxicillin-clavulanic acid or cefuroxime**, given approximately **30–60 minutes before the surgical procedure**, according to the institutional protocol.

Data Collection

Data were obtained from patient medical records, operative notes, and postoperative follow-up documentation. The following variables were recorded:
Patient **age and gender**
Type of surgical procedure performed
Duration of surgery
Use of pre-operative antibiotics
Type and dosage of antibiotic administered
Postoperative antibiotic prescription
Occurrence of postoperative surgical site infection
Postoperative infection was identified based on clinical signs such as **pain, swelling, redness, purulent discharge, delayed wound healing, or abscess formation** observed during follow-up visits.

Outcome Measures

The **primary outcome measure** of the study was the **incidence of postoperative surgical site infection** in patients who received pre-operative antibiotics compared with those who did not.
The **secondary outcomes** included the relationship between infection rates and factors such as **type of surgery, duration of surgery, and patient demographics**.

Statistical Analysis

The collected data were entered into **Microsoft Excel** and analyzed using **Statistical Package for the Social Sciences (SPSS) software version 25.0**. Descriptive statistics were used to summarize patient demographics and clinical characteristics. Categorical variables were presented as **frequencies and percentages**, while continuous variables were expressed as **mean ± standard deviation**.
The **Chi-square test** was used to compare the incidence of postoperative infections between the two groups. A **p-value of less than 0.05** was considered statistically significant.

Ethical Considerations

All patient data were handled confidentially, and no identifying information was disclosed. The study adhered to the ethical principles of biomedical research involving human subjects, and institutional approval was obtained before reviewing patient records.

Results

A total of **100 patients** who underwent major oral and maxillofacial surgical procedures were included in this retrospective study. The patients were divided into two groups based on the administration of pre-operative antibiotics. **Group A (n = 50)** received pre-operative antibiotics, while **Group B (n = 50)** did not receive pre-operative antibiotics. Postoperative infection rates and demographic characteristics were analyzed.

Demographic Characteristics of the Study Population

The age of the patients ranged from **18 to 65 years**, with a mean age of **36.8 ± 11.2 years**. Among the total participants, **58% were male and 42% were female**. The distribution of patients in both groups was comparable with respect to age and gender.

Table 1: Demographic Characteristics of Patients (n = 100)

Variable	Group A (Antibiotics) n=50	Group B (No Antibiotics) n=50	Total
Mean Age (years)	37.2 ± 10.8	36.4 ± 11.6	36.8 ± 11.2
Male	30 (60%)	28 (56%)	58 (58%)
Female	20 (40%)	22 (44%)	42 (42%)

As shown in **Table 1**, both groups demonstrated a similar demographic distribution, indicating comparability between the study groups.

Distribution of Surgical Procedures

Different types of major oral and maxillofacial surgical procedures were performed in the study population. The most common procedures included **fracture fixation, cyst or tumor enucleation, orthognathic surgery, and bone grafting procedures**.

Table 2: Distribution of Types of Surgical Procedures

Type of Surgery	Group A (n=50)	Group B (n=50)	Total
Fracture fixation	18 (36%)	16 (32%)	34 (34%)
Cyst/Tumor enucleation	14 (28%)	15 (30%)	29 (29%)
Orthognathic surgery	10 (20%)	11 (22%)	21 (21%)
Bone grafting procedures	8 (16%)	8 (16%)	16 (16%)

As presented in **Table 2**, fracture fixation procedures accounted for the largest proportion of surgeries (34%), followed by cyst or tumor enucleation (29%).

Postoperative Infection Rates

Postoperative infections were assessed based on clinical signs including swelling, redness, purulent discharge, and delayed wound healing during follow-up visits.

Table 3: Comparison of Postoperative Infection Rates

Outcome	Group A (Antibiotics) n=50	Group B (No Antibiotics) n=50	Total
Infection Present	4 (8%)	10 (20%)	14 (14%)
No Infection	46 (92%)	40 (80%)	86 (86%)

As shown in **Table 3**, postoperative infection was observed in **8% of patients who received pre-operative antibiotics**, compared with **20% of patients who did not receive antibiotics**, indicating a lower infection rate in the antibiotic group.

Association Between Pre-operative Antibiotics and Infection Rate (STATA Analysis)

Statistical analysis was performed to determine whether the difference in infection rates between the two groups was statistically significant.

Table 4: STATA Chi-Square Test for Association Between Antibiotic Use and Infection

Variable	Infection Present	No Infection	Total
Pre-operative Antibiotics	4	46	50
No Pre-operative Antibiotics	10	40	50

STATA Output

Statistic	Value
Pearson Chi2 (1)	3.03
p-value	0.081
Odds Ratio	2.87
95% Confidence Interval	0.82 – 10.05

The **Chi-square test ($\chi^2 = 3.03$, $p = 0.081$)** indicated that although infection rates were higher in patients who did not receive pre-operative antibiotics, the difference **did not reach statistical significance at $p < 0.05$**. However, the **odds ratio of 2.87** suggests that patients without pre-operative antibiotics had nearly **three times higher risk of postoperative infection**.

Influence of Duration of Surgery on Infection Rate

The relationship between surgical duration and postoperative infection was also analyzed.

Table 5: Duration of Surgery and Infection Rate

Duration of Surgery	Infection Present	No Infection	Total
< 2 hours	5 (7.7%)	60 (92.3%)	65
≥ 2 hours	9 (25.7%)	26 (74.3%)	35
Total	14	86	100

As shown in **Table 5**, procedures lasting **two hours or longer showed a higher infection rate (25.7%)** compared to surgeries lasting less than two hours (7.7%). This indicates that longer surgical duration may increase the risk of postoperative infection.

Overall, the results of this study demonstrated that **patients receiving pre-operative antibiotics showed a lower incidence of postoperative infections compared to those who did not receive antibiotics**. However, statistical analysis revealed that the difference was **not statistically significant**, although the trend suggests a potential protective effect of pre-operative antibiotic administration in major oral and maxillofacial surgeries.

DISCUSSION

Postoperative infection remains one of the most important complications following major oral and maxillofacial surgical procedures. These infections can negatively affect wound healing, prolong hospital stay, and increase treatment costs. The present retrospective study evaluated the **impact of pre-operative antibiotic use on postoperative infection rates** among patients undergoing major oral and maxillofacial surgeries. In this study, patients who received pre-operative antibiotics showed a **lower infection rate (8%) compared with patients who did not receive antibiotics (20%)**, although the difference was **not statistically significant ($p = 0.081$)**. These findings suggest a possible protective effect of pre-operative antibiotic prophylaxis; however, the statistical significance was not strong enough to conclusively establish its benefit in all cases.

The results of the present study are consistent with several previous investigations that have explored the role of antibiotic prophylaxis in oral and maxillofacial surgery. For instance, **Tuckett et al. (2022)** [16] conducted a retrospective cohort study evaluating infection rates in patients with isolated midface fractures. The authors reported that infection rates were extremely low and that there was **no statistically significant difference between patients who received prophylactic antibiotics and those who did not**. The study concluded that routine prophylactic antibiotic use for such fractures should be reconsidered. These findings are similar to those of the present study, where the difference in infection rates between the antibiotic and non-antibiotic groups was also not statistically significant.

Another study by **Atwez et al. (2023) [17]** investigated the effectiveness of preoperative antibiotic prophylaxis in mandibular fracture surgeries. The authors observed that mandibular fractures generally have higher postoperative infection rates compared with other facial fractures. However, the study reported that **postoperative antibiotic duration did not significantly reduce surgical site infection rates**, suggesting that prolonged or unnecessary antibiotic use may not provide additional benefit. This finding supports the conclusion of the present study that

antibiotic administration should be carefully evaluated rather than used routinely.

Similarly, **Milic et al. (2021)** [18] conducted a systematic review evaluating antibiotic prophylaxis across various oral and maxillofacial surgical procedures. The authors emphasized that surgical site infections can lead to considerable morbidity and highlighted the importance of balancing infection prevention with the risk of antibiotic-related adverse effects. Their review suggested that antibiotic prophylaxis may be beneficial in **high-risk or contaminated surgical procedures**, but routine use in all maxillofacial surgeries may not always be necessary. The conclusions of their review align with the findings of the current study, which demonstrated reduced infection rates in the antibiotic group but without strong statistical significance.

In contrast, **Andreasen et al. (2006)** [19] performed a systematic review focusing on antibiotic prophylaxis in maxillofacial fracture treatment and found that antibiotic administration resulted in a **threefold reduction in infection rates in mandibular fracture cases** compared with control groups. These findings suggest that antibiotics may be particularly beneficial in procedures involving contaminated fractures or communication with the oral cavity. The lower infection rate observed in the antibiotic group in the present study is consistent with this observation, although our results did not demonstrate statistical significance.

Furthermore, a meta-analysis by **Mundinger et al. (2018)** [20] evaluated postoperative antibiotic therapy in facial fracture management. The authors concluded that **extended postoperative antibiotic use did not significantly reduce the incidence of surgical site infections**, emphasizing that prolonged antibiotic therapy may not be necessary when adequate perioperative prophylaxis is provided. These results reinforce the concept that appropriate timing and indication of antibiotics may be more important than routine or prolonged administration.

The variability in findings across different studies may be attributed to several factors, including differences in surgical procedures, patient health status, operative duration, and antibiotic regimens. In the present study, surgical duration also appeared to influence infection rates, with procedures lasting **more than two hours showing a higher incidence of postoperative infection**. Longer surgical time may increase tissue exposure and bacterial contamination, thereby elevating infection risk. This observation supports previous literature indicating that operative duration is an important risk factor for surgical site infections in maxillofacial surgery.

Another important aspect highlighted in recent literature is the issue of **antibiotic resistance and antimicrobial stewardship**. Excessive or inappropriate antibiotic use can contribute to the development of resistant bacterial strains and increase the risk of adverse drug reactions. Therefore, many researchers advocate for a **selective approach to antibiotic prophylaxis**, reserving it for patients with higher risk factors such as immunocompromised status, contaminated surgical fields, or complex reconstructive procedures.

Overall, the findings of the present study contribute to the ongoing debate regarding the routine use of pre-operative antibiotics in oral and maxillofacial surgery. While our results indicate a trend toward lower infection rates among patients receiving prophylactic antibiotics, the lack of statistical significance suggests that antibiotics may not be necessary for all patients. Instead, individualized treatment planning based on surgical complexity, patient health status, and risk of infection may be a more appropriate strategy for optimizing surgical outcomes while minimizing unnecessary antibiotic exposure.

LIMITATIONS

This study has several limitations that should be considered when interpreting the findings. First, the **retrospective study design** relies on previously recorded clinical data, which may lead to incomplete documentation or potential information bias. Second, the **sample size of 100 patients** may not be large enough to detect small but clinically significant differences in infection rates between the groups. Third, variations in **types of surgical procedures, duration of surgery, and patient-related factors** such as oral hygiene, systemic health conditions, and smoking status were not fully controlled and may have influenced the occurrence of postoperative infections. Additionally, differences in **antibiotic type, dosage, and postoperative antibiotic use** could also affect the outcomes. Finally, since the study was conducted in a **single institution**, the results may not be fully generalizable to other clinical settings or populations. Further **large-scale, multicenter prospective studies** are recommended to provide more definitive evidence regarding the role of pre-operative antibiotics in preventing postoperative infections in major oral and maxillofacial surgeries.

CONCLUSION

Pre-operative antibiotic use showed a lower rate of postoperative infections in patients undergoing major oral and maxillofacial surgeries compared to those who did not receive antibiotics. However, the difference between the two groups was not statistically significant. The findings suggest that while antibiotic prophylaxis may have a protective effect, its routine use for all patients may not always be necessary. Careful evaluation of patient risk factors, surgical complexity, and duration of surgery should guide antibiotic administration. Further large-scale prospective studies are required to establish clear clinical guidelines for antibiotic prophylaxis in oral and maxillofacial surgery.

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