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Effectiveness of Preoperative Single Dose Antibiotics in Surgical Removal of Impacted Mandibular Third Molar -A Prospective Clinical Study

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Abstract

Introduction: The surgical extraction of third molars is commonly performed in dentistry under local anesthesia on an outpatient basis. In minor oral surgery, various antibiotic regimens are employed. Antimicrobial resistance, driven by factors such as antibiotic overuse and misuse, poses a significant challenge, necessitating a more restricted and judicious use of antibiotics.

Aim: To evaluate the effectiveness of a single preoperative dose of amoxicillin (1 gm.) administered one hour before the procedure, compared to the routine postoperative antibiotic therapy given for five days in mandibular third molar surgery.

Materials and Methods: This Prospective clinical study was conducted at FDS, Ramaiah University of Applied Sciences, Bangalore, Karnataka, India, from February 2024 to June 2024, among 40 patients with impacted mandibular third molars. Each subject underwent tooth removal with either a single dose of oral amoxicillin (1gm) one hour preoperatively (Group A) or thrice-daily amoxicillin (500 mg) for five days postoperatively (Group B). Patients were evaluated on the 3rd, 7th, and 14th postoperative days for surgical site infection, pain, and swelling. The Chi-square test was used for statistical analysis.

Results: Among the 40 patients selected for this study, 24 (60%) were female and 16 (40%) were male, with a mean age of 28.03±6.95 years. Pain and swelling resolved completely by the 14th postoperative day in all subjects.

No significant difference was noted in the intergroup comparison.

Conclusion: In this study, no surgical site infections were observed in either group. The administration of 1 gram of oral amoxicillin one hour preoperatively and 500 mg of amoxicillin postoperatively for five days showed no statistically significant difference in outcomes. This suggests that single dose antibiotic is as effective as postoperative antibiotic therapy.

Keywords: Antibiotics, Pain, Swelling, Surgical Site Infection, Single Dose.

Introduction

The surgical procedure involving impacted third molars is prevalently recognized as the most frequent minor operation within the domain of Oral and Maxillofacial surgery. Commonly observed post-operative effects encompass pain, swelling, and trismus (1,2) . To address these consequences and minimize the risk of infection, healthcare professionals predominantly recommend the administration of antibiotics alongside analgesics or anti-inflammatory medications. Within the clinical setting, the conventional approach involves prescribing post-operative antibiotics, either as a singular agent or in conjunction, for a span of 3 to 7 days. On occasion, a pre-operative antibiotic administered as a single dose serves a similar preventive purpose. (3)

The issue of antibiotic usage in the context of lower 3rd molar extraction is indeed a topic of ongoing discussion in the field of oral and maxillofacial surgery and the increasing concern regarding the development of antimicrobial resistance and the potential for adverse outcomes related to antibiotic use has led to a revaluation of this practice. (4)

Studies have indicated that the routine use of antibiotic prophylaxis may not be necessary in the case of 3rd molar extraction. However, it is crucial to recognize that the evidence on this matter is still evolving, and a universally accepted consensus has not yet been established (5,6). To address this issue effectively, ongoing research efforts are needed to establish clear guidelines and protocols for antibiotic usage in the context of oral and maxillofacial surgeries, taking into consideration both the clinical efficacy and the broader implications for public health, particularly in terms of antimicrobial resistance (7). Infection control practices followed, the study setting, type of anaesthesia and patient considerations has resulted in varied antibiotic prescribing practices across countries/populations. This has led to misuse/overuse of antibiotics especially in private practice settings to avoid potential complications, contributing to the overall antibiotic resistance. (7,8)

It is crucial to evaluate the connection between the complexity of tooth extraction, the use of antibiotics for preventive measures, and any potential complications after surgery. Furthermore, it is essential to offer a research-based analysis on the utilization of antibiotic prophylaxis in the removal of lower third molars.

Research findings have indicated that in some cases, the use of antibiotics in surgical procedures has not led to improved outcomes, with no discernible difference observed between antibiotic use and placebos, or even in situations where antibiotics were administered after an infection had developed. (8-10) This has raised doubts about the necessity of prescribing antibiotics following third molar surgery. Conversely, studies have shown that a single pre-operative dose of antibiotics can effectively lower post-operative infection rates when compared to post operatively.

This paper aims to the evaluate the effectiveness of single dose pre-operative antibiotic versus post-operative antibiotics in improving outcomes. This evidence will influence the prescribing practices in third molar surgery.

Reduction in the usage of antibiotics and improved quality of life is the outcome desirable.

Materials and Methods

This study was conducted at Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences Ramaiah University of Applied Sciences, Bangalore, Karnataka, India, during the period February 2024 to June 2024.

Inclusion criteria: Both male and female patients belonging to the age group of 18-45 years who had not taken antibiotics or anti-inflammatory drugs within two weeks before the procedure.

Exclusion criteria: Patients were excluded if they presented with local pathologies associated with third molar, had other systemic illnesses, were immunocompromised, were allergic to amoxicillin, were pregnant, presented with an abscess or cellulitis, demonstrated non-compliance in taking postoperative medication, had a known allergy to lignocaine, or were unable to attend follow-up appointments.

Sample size determination:

The sample size calculation for this study was performed using the Cochrane formula to estimate proportions, where the estimated population proportion (p) was determined to be 0.74 based on the knowledge percentage from a previous study by Passi et al. (2019). The Cochrane formula used is

$$n = \frac{Z_{\alpha/2}{}^2 \, p(1-p)}{e^2}$$

n = sample size

$Z_{\alpha/2}$ =Z value at 95% confidence level

e = acceptable sampling error

p = the population proportions

For this calculation, a 95% confidence level was selected, giving a Z value of 1.96, and the margin of error was set at 10%. Substituting these values into the formula, a sample size of 29 participants was obtained. To account for potential dropouts, the sample size was increased, resulting in 40 subjects.

Interventions

Subjects were allocated into two groups

Group A: Pre-operative single dose antibiotics

Group B: Post-operative course of antibiotics

Local anesthesia was administered using 2% lignocaine with 1:200,000 adrenaline, utilizing classic inferior alveolar, lingual, and long buccal nerve blocks. The impacted teeth were surgically removed, with or without sectioning. Postoperative instructions included biting on gauze for 10–20 minutes, avoiding spitting for 24 hours, taking prescribed medications regularly, applying an ice pack extra-orally within 24 hours, performing warm saline rinses after 24 hours, and avoiding smoking and vigorous rinsing. The analgesic regimen was Aceclofenac 100mg twice daily for 5 days. Patients were evaluated on the 3rd, 7th, and 14th postoperative days for surgical site infection, pain, swelling, and mouth opening, all recorded as binary outcomes (complication present or absent). The procedure was performed by a single surgeon for all patients.

The primary outcome variable in this study was the incidence of surgical site infection (SSI). SSI was diagnosed based on visual evidence of erythema, edema, or the presence of purulent discharge (PD) at the extraction site. The presence of PD, either alone or in combination with erythema and edema, was considered indicative of SSI. An increase in pain between the 3rd and 10th postoperative days, persistent or worsening swelling between the 4th and 10th postoperative days, and PD from the surgical site were also noted.

Statistical Analysis

Data were tabulated in Microsoft Excel 2021, and statistical analysis was performed using IBM SPSS Statistics for Windows, Version 27.0 (Armonk, NY: IBM Corp). Graphs, box plots, and pie charts were created using GraphPad Prism for Windows, Version 10.1.2 (GraphPad Software, La Jolla, CA, USA). Descriptive statistics were used to report categorical variables as frequencies and percentages, while quantitative variables were presented as mean and standard deviation (SD). The chi-square test was used for analyzing categorical variables, and an independent samples t-test was conducted for inter-group age comparisons. A P-value of ≤0.05 was considered statistically significant.

Results

Table 1: Demographic Characteristics of the study subjects in both groups

Demographic Characteristics		Group A (n=20)	Group B (n=20)	Total (N=40)
Age [a]		27.7±8.71	30.6±6.35	28.03±6.95
Gender [b]	Females	14(63.6%)	10(55.6%)	24(60%)
	Males	8(36.4%)	8(44.4%)	16(40%)

N: Total sample size; n: sample size per group

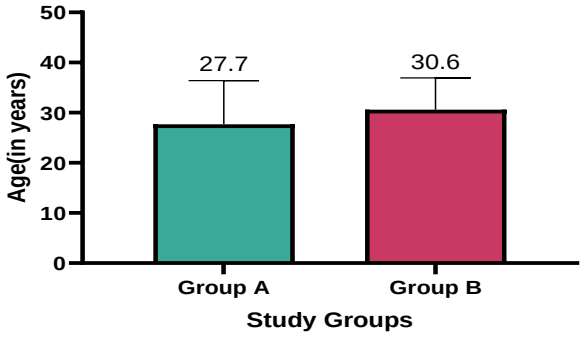
a: analyzed by Independent sample t-test

b: analyzed by Chi-square test

The overall mean age of the subjects included in the study was found to be 28.03±6.95 years, while the mean age of the subjects in Group I was found to be 27.7±8.71 years, and for Group II: 30.6±6.35 years. When the mean age was compared by the Independent sample t-test test between the two study groups, it revealed that there was no statistically significant difference (P=0.23), implying that the subjects were matched for the age variable, thus nullifying the confounding effect of age on the study outcomes.

In the present study sample, the proportion of Females was found to be slightly higher (60%, n=24). The corrected Chi-Square (χ^2) test of independence was carried out to compare the frequency distribution of the study subjects between the study groups according to gender. No significant association was found (P=0.6), implying that the subjects were matched for the gender variable, thus nullifying the confounding effect of gender on the study outcomes.

Bar Graph: Mean Age of study subjects according to study groups



Bar Graph: Distribution of study subjects according to Gender across study groups

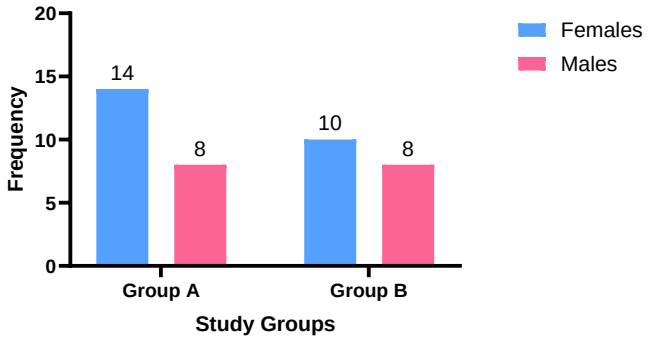


Table 2: Distribution of study subjects according to Type of Impaction across study groups

Type of Impaction	Group A (n=20)	Group B (n=20)	Total (N=40)
Distoangular	5(25%)	4(20%)	9(22.5%)
Horizontal	5(25%)	5(25%)	10(25%)
Mesioangular	8(40%)	5(25%)	13(32.5%)
Vertical	3(15%)	5(25%)	8(20%)

N: Total sample size; n: sample size per group

a: analyzed by Chi-square test

In the present study sample, the proportion of mesioangular impacted third molars was found to be slightly higher (32.5%, n=13). The corrected Chi-Square (χ^2) test of independence was carried out to compare the frequency distribution of the study subjects between the study groups according to the type of impaction. No significant association was found (P=0.73), implying that the subjects were matched for the type of impaction variable, thus nullifying the confounding effect of gender on the study outcomes.

Bar Graph: Distribution of study subjects according to Type of Impaction across study groups

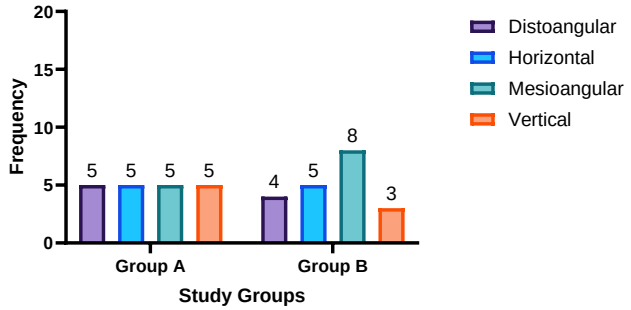


Table 3: Evaluation of pain between the study groups at various time points.

Time Points	Group A (n=20)	Group B (n=20)	P value§
Day 3	18(90%)	16(80%)	0.38 NS
Day 7	2(10%)	4(20%)	
Day 14	0(0%)	0(0%)	
P value‡	<0.0001*	<0.0001*	

N: Total sample size; n: sample size per group

§: Inter-group comparisons (between the study groups); ‡: Intra-group comparisons (between the time periods within each study group)

NS: not significant (P >0.05), *: statistically significant (P <0.05).

Intra-group comparisons

For Group A, on Day 3, 18 cases (90%) were observed, which reduced significantly on Day 7 (2 cases,10%), and Day 14 (0 cases, 0%) [P<0.0001].

For Group B, on Day 3, 16 cases (80%) were observed, which reduced significantly on Day 7 (4 cases,20%), and Day 14 (0 cases, 0%) [P<0.0001].

Inter-Group comparisons

The proportion of cases with pain was compared between the study groups stratified by different time points, revealing no significant association (P=0.38). This suggests that the incidence of pain across time was not dependent on the study groups, indicating equivalence between the groups.

Bar Graph: Evaluation of pain between the study groups at various time points.

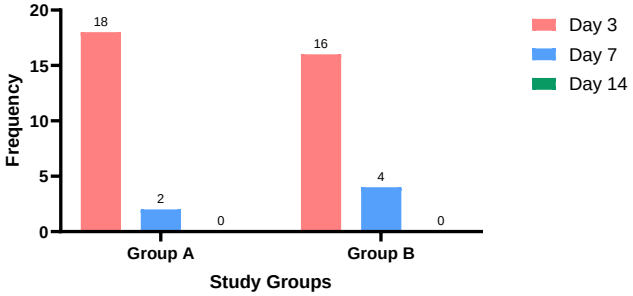


Table 4: Evaluation of swelling between the study groups at various time points.

Time Points	Group A (n=20)	Group B (n=20)	P value§
Day 3	19(95%)	17(85%)	0.29 NS
Day 7	1(5%)	3(15%)	
Day 14	0(0%)	0(0%)	
P value‡	<0.0001*	<0.0001*	

N: Total sample size; n: sample size per group

§: Inter-group comparisons (between the study groups); ‡: Intra-group comparisons (between the time periods within each study group)

NS: not significant (P >0.05), *: statistically significant (P <0.05)

Intra-group comparisons

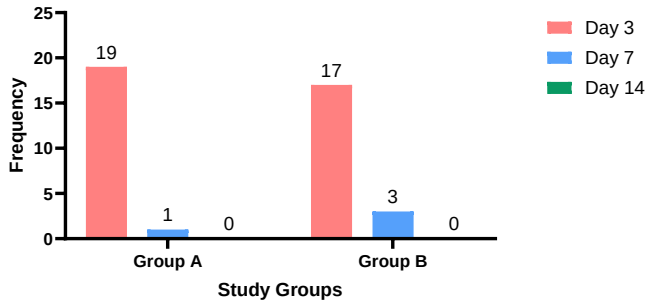
For Group A, on Day 3, 19 cases (95%) were observed, which reduced significantly on Day 7 (1 case,5%), and Day 14 (0 cases, 0%) [P<0.0001].

For Group B, on Day 3, 17 cases (85%) were observed, which reduced significantly on Day 7 (3 cases,15%), and Day 14 (0 cases, 0%) [P<0.0001].

Inter-Group comparisons

The proportion of cases with swelling was compared between the study groups stratified by different time points, revealing no significant association (P=0.29). This suggests that the incidence of swelling across time was not dependent on the study groups, indicating equivalence between the groups.

Bar Graph: Evaluation of swelling between the study groups at various time points.



Discussion

Surgical wounds are categorized by the National Research Council as clean, clean-contaminated, contaminated, or dirty (11). Surgically impacted mandibular third molar surgeries fall under the clean-contaminated category. These surgeries are typically performed to address issues such as pericoronitis, periodontitis, periapical abscesses, cysts or neoplasms, resorption of adjacent roots, inflammation of opposing soft tissue, as well as for prosthetic and orthodontic purposes. (12)

It has been shown that pure anaerobic strains do not cause infection on their own, as they require aerobic microorganisms for growth. This understanding forms the basis of antibiotic prophylaxis, suggesting that effectiveness against aerobes is sufficient and that total effectiveness against anaerobes may not be necessary (13). Oral surgeries are performed in environments with high bacterial loads, predisposing patients to postoperative infections. Antibiotic resistance has been a concern since the advent of antibiotics, but the emergence of dangerous, resistant microorganisms has become more frequent in the past twenty years. This resistance, combined with a decline in new antibiotics, may eventually lead to a post-antibiotic era. (14,15)

According to the present study, the study sample showed a slightly higher proportion of females, but this was not significantly associated (P=0.6), indicating that gender was not a confounding factor. Similarly, the proportion of mesioangular impacted third molars was slightly higher (32.5%, n=13), with no significant association (P=0.73), suggesting that impaction type did not confound the results.

Pain Evaluation

Intra-Group Comparisons: For Group A, pain was observed in 90% of cases on Day 3, decreasing significantly to 10% on Day 7 and 0% on Day 14 [P<0.0001]. In Group B, pain was present in 80% of cases on Day 3, significantly decreasing to 20% on Day 7 and 0% on Day 14 [P<0.0001].

Inter-Group Comparisons: No significant difference in pain incidence between groups over time (P=0.38) indicates group equivalence.

Swelling Evaluation

Intra-Group Comparisons: For Group A, swelling was observed in 95% of cases on Day 3, significantly decreasing to 5% on Day 7 and 0% on Day 14 [P<0.0001]. For Group B, swelling was present in 85% of cases on Day 3, significantly reducing to 15% on Day 7 and 0% on Day 14 [P<0.0001].

Inter-Group Comparisons: No significant difference in swelling between groups over time (P=0.29), suggesting group equivalence.

Prophylactic antibiotic therapy involves administering antimicrobial agents to prevent infection. Effective prophylaxis requires that the antibiotic penetrate bone adequately, be well-distributed in body fluids, and be active against relevant microorganisms. The chosen antibiotic should have bactericidal activity, a narrow spectrum to minimize resistance, and be the least toxic yet potent. (16-20)

Some studies suggest routine antibiotic prophylaxis for third molar surgery may be unnecessary. Evidence both supports and questions the benefits of routine prophylactic antibiotics in reducing postoperative infection risk(21-24). Infectious complications may arise from factors such as third molar position, anatomy, surgical trauma and duration, or the surgeon's experience (25,26).

In the present study, we had no case of SSI in and also no restricted mouth openings in both groups respectively.

According to Halpern LR and Dodson TB found an 8.5% incidence of surgical site infection (SSI) with preoperative IV placebo compared to prophylactic IV penicillin, which showed a statistically significant reduction (p=0.03) (29). Monaco G et al. reported that 2 grams of oral amoxicillin administered one hour before the procedure significantly reduced SSI compared to no antibiotics (10). Sane VD et al. observed only 1 SSI (2%) with a single preoperative antibiotic dose, concluding its benefit in reducing SSI (16).

Ren YF and Malmstrom HS's meta-analysis revealed a 4% SSI rate with systemic antibiotics versus 6.1% with placebo, supporting the efficacy of systemic antibiotics in reducing SSI (30). Mehrabi M et al. found a 10% SSI rate for SIM3M surgeries, recommending prophylaxis for clean-contaminated, contaminated, and dirty wounds (27). Olusanya AA et al. suggested that a single dose of oral prophylactic antibiotic is generally sufficient for third molar surgery, with additional doses warranted for higher trauma cases (28).

Conclusion

In this study, no surgical site infections were observed in either group. The administration of 1 gram of oral amoxicillin one hour preoperatively and 500 mg of amoxicillin postoperatively for five days following the surgical removal of impacted mandibular third molars showed no statistically significant difference. This suggests that there is no major difference in the surgical outcomes between the group that received single dose antibiotic preoperatively versus the group that received antibiotics 5 days postoperatively. Further research warranted with larger sample sizes to evaluate the effectiveness of single-dose antibiotics for impacted mandibular third molars.

We found few articles related to the effectiveness of single-dose antibiotics in impacted third molar surgery.

Author's name and year	Place of study	No. of subjects	Intervention	Parameters assessed	Conclusion
Olojede OA et al., [24] 2014	Nigeria	62	Group I (n=31) had administration of 1 gram of oral metronidazole and 1 gram of amoxicillin capsules 30 minutes preoperative and Group II (n=31) had 500 milligrams of amoxicillin capsule 8 hourly and 400 milligrams of metronidazole tablets administered postoperatively for 5 days.	Pain, facial swelling and mouth opening assessment were done postoperatively and on days 1st, 3rd and 7th.	Administration of preoperative or postoperative antibiotics showed no marked differences in the degree of postoperative sequalae that occur after impacted mandibular third molar extractions.
Olusanya AA et al., [56] 2011	Nigeria	79	Patients in preoperative group were given oral bolus of 2 gm amoxycillin capsules and 1 gm metronidazole tablets one hour before extraction, while those in the postoperative group were given a five-day regimen oral 500 mg amoxycillin capsules thrice daily and 400 mg metronidazole tablets thrice daily	The occurrence of postoperative pain, swelling, trismus, SSI and AO were compared between the groups.	Single bolus antibiotic prophylaxis should be adequate for most cases of third molar surgery as the degree of postoperative pain, swelling and trismus was similar in both groups. However, a five-day postoperative antibiotic regimen is advised in patient with risk factors for AO.
Reiland MD et al., [54] 2017	Rochester, Minnesota	1895	Group A subjects were treated with postoperative PO antibiotics alone (5-day course of amoxicillin) and the subjects treated in group B were treated with perioperative i.v. antibiotics (amoxicillin).	Primary outcome variables assessed were alveolar osteitis & surgical sit infection.	The use of a postoperative PO antibiotic regimen versus perioperative i.v. antibiotic regimen does not significantly alter the incidence of AO or SSI following elective third molar removal. if the surgeon chooses to use antibiotics in the setting of third molar surgery, perioperative i.v. antibiotics are preferable over postoperative PO antibiotics.
Sane VD et al., [26] 2014	Mysore, India	30	Each subject acted as his/her own control in which the impacted tooth on one side was treated with conventional postsurgical PO antibiotics (cap. amoxicillin 500 mg thrice daily for 5 days) representing Group-A and the impacted 3rd molar on the other	Primary outcome variables assessed were alveolar osteitis and surgical site infection.	Administering 1 gm of injectable amoxicillin 1 hour preoperatively versus 500 mg of oral amoxicillin postoperatively for 5 days showed no statistically significant difference, indicating that a single 1 gm dose of injectable amoxicillin 1 hour

			side was removed after 2 weeks with a single-dose preoperative i.v. antibiotic (Inj. amoxicillin 1 gm) 1 hour before the procedure (Group-B		before surgery is both effective and cost-efficient for lower third molar extraction.
Sathish et.al 2021	Mysore, India	30	Each subject acted as his/her own control in which the impacted tooth on one side was treated with conventional postsurgical PO antibiotics (cap. amoxicillin 500 mg thrice daily for 5 days) representing Group-A and the impacted 3rd molar on the other side was removed after 2 weeks with a single-dose preoperative i.v. antibiotic (Inj. amoxicillin 1 gm) 1 hour before the procedure (Group-B)	Primary outcome variables assessed were alveolar osteitis and surgical site infection.	Inj. amoxicillin 1 gm administered 1 hour preoperatively, and cap. amoxicillin 500 mg administered post surgically for 5 days had no statistically significant difference, hence suggesting that 1 gm Inj. amoxicillin administered 1 hour prior to surgery is a beneficial and cost-effective alternative in lower third molar surgery.
Present study 2024	Bangalore, India	40	Group A: Single dose preoperative antibiotic and Group B: Postoperative course of antibiotics was given. One Group given Amoxicillin 500mg given 1g orally preoperatively 1 hour before the procedure and other Group given postoperatively Novomox 500mg.	Primary outcome variables assessed was surgical site infection, Pain and swelling	In this study, no surgical site infections were observed in either group. The administration of 1 gram of amoxicillin one hour preoperatively and 500 mg of amoxicillin postoperatively for five days following the surgical removal of impacted mandibular third molars showed no statistically significant difference. This suggests that there is no major difference in the effectiveness of antibiotics taken preoperatively versus postoperatively.

References

1. Poeschl PW, Eckel D, Poeschl E. Postoperative prophylactic antibiotic treatment in third molar surgery- a necessity? J Oral Maxillofac Surg. 2004;62(1):03-08.
2. Ataoglu H, Öz GY, Çandirli C, Kizilog˘lu D. Routine antibiotic prophylaxis is not necessary during operations to remove third molars. British Journal of Oral and Maxillofacial Surgery. 2008;46(2):133-35.
3. Kaczmarzyk T, Wichlinski J, Stypulkowska J, Zaleska M, Panas M, Woron J. Single-dose and multi-dose clindamycin therapy fails to demonstrate efficacy in preventing infectious and inflammatory

complications in third molar surgery. Int J Oral Maxillofac Surg. 2007;36(5):417-22.

4. Lockhart PB, Tampi MP, Abt E, Aminoshariae A, Durkin MJ, Fouad AF, et al. Evidence-based clinical practice guideline on antibiotic use for the urgent management of pulpal- and periapical-related dental pain and intraoral swelling: A report from the American Dental Association. J Am Dent Assoc. 2019;150(11):906- 21.e12. Available from: https://doi.org/10.1016/j.adaj.2019.08.020.
5. Sane VD, Gadre KS, Chandan S, Ramanojam S, Singh V, Halli R. Efficacy of single dose azithromycin as prophylactic antibiotic in surgical removal of mandibular third molars: A clinical study. J Maxillofac Oral Surg. 2013;12(4):382-86.
6. Happonen RP, Bäckström AC, Ylipaavalniemi P. Prophylactic use of phenoxymethylpenicillin and tinidazole in mandibular third molar surgery, a comparative placebo controlled clinicaltrial. Br J Oral Maxillofac Surg. 1990;28:12.
7. Fair RJ, Tor Y. Antibiotics and bacterial resistance in the 21st century. Perspectives in Medicinal Chemistry. 2014;(6):25-64.
8. Hutchings M, Truman A, Wilkinson B. Antibiotics: Past, present and future. Vol. 51, Current Opinion in Microbiology. Elsevier Ltd; 2019. Pp. 72-80.
9. Passi D, Singh G, Dutta S, Srivastava D, Chandra L, Mishra S, et al. Study of pattern and prevalence of mandibular impacted third molar among Delhi-National Capital Region population with newer proposed classification of mandibular impacted third molar: A retrospective study. Natl J Maxillofac Surg. 2019;10(1):59- 67. Doi: 10.4103/njms.NJMS_70_17. PMID: 31205390; PMCID: PMC6563636.
10. Monaco G, Tavernese L, Agostini R, Marchetti C. Evaluation of antibiotic prophylaxis in reducing postoperative infection after mandibular third molar extraction in young patients. Journal of Oral and Maxillofacial Surgery [Internet]. 2009;67(7):1467-72.
11. Rabi A, Maheshwari R, Srinivasan B, Warad LP, Suvarna CC, Tank KS. Effectiveness of antimicrobial therapy after extraction of impacted mandibular third molar: A randomised clinical trial. J Contemp Dent Pract. 2018;19(1):81-85.
12. Marcussen KB, Laulund AS, Jørgensen HL, Pinholt EM. A systematic review on effect of single-dose preoperative antibiotics at surgical osteotomy extraction of lower third molars. Journal of Oral and Maxillofacial Surgery [Internet]. 2016;74(4):693-703.
13. Pasupathy S, Alexander M. Antibiotic prophylaxis in third molar surgery. J Craniofac Surg. 2011;22(2):551-53.
14. Olojede OA, Gbotolorun OM, Andersen AAI, Emeka CI, Arotiba GT, Akinwande JA. Comparative study of skeletal stability between postoperative skeletal intermaxillary fixation and no skeletal fixation after bilateral sagittal split ramus osteotomy: An 18 months retrospective study. J Oral Maxillofac Res. 2014;5(2):01-06.
15. Lee JY, Do HS, Lim JH, Jang HS, Rim JS, Kwon JJ, et al. Correlation of antibiotic prophylaxis and difficulty of extraction with postoperative inflammatory complications in the lower third molar surgery. British Journal of Oral and Maxillofacial Surgery. 2014;52(1):54-57.
16. Sane VD, Gadre KS, Chandan S, Halli R, Saddiwal R, Kadam P. Is postoperative antibiotic therapy justified for surgical removal of mandibular third molar? A comparative study. J Maxillofac Oral Surg. 2014;13(2):189-94.

17. Monaco G, Staffolani C, Gatto MR, Checchi L. Antibiotic therapy in impacted third molar surgery. Eur J Oral Sci. 1999;107(6):437-41.
18. Roychoudhury A, Singh S, Arora A, Bhutia O, Das B, Pandey S. Antibiotics in third molar extraction; are they really necessary: A non-inferiority randomised controlled trial. Natl J Maxillofac Surg. 2014;5(2):166.
19. Morrow AJ, Dodson TB, Gonzalez ML, Chuang SK, Lang MS. Do postoperative antibiotics decrease the frequency of inflammatory complications following third molar removal? J Oral Maxillofac Surg. 2018;76(4):700-08.
20. Bergdahl M, Hedström L. Metronidazole for the prevention of dry socket after removal of partially impacted mandibular third molar: A randomised controlled trial. Br J Oral Maxillofac Surg. 2004;42(6):555-58.
21. Cruse PJE, Foord R. A five-year prospective study of 23,649 surgical wounds. Archives of Surgery. 1973;107(2):206-10.
22. Koerner KR. The removal of impacted third molars. Principles and procedures. Dent Clin North Am. 1994;38(2):255-78. Review.
23. Greenberg RN, James RB, Marier RL, Wood WH, Sanders CV, Kent JN. Microbiologic and antibiotic aspects of infections in the oral and maxillofacial region. J Oral Surgery. 1979;37:873-84.
24. Moenning JE, Nelson CL, Kohler RB. The microbiology and chemotherapy of odontogenic infections. J Oral Maxillofac Surg. 1989;47:976-85.
25. Takazoe I, Tanaka M, Homma T. A pathogenic strain of bacteroides melaninogenicus. Arch Oral Biol. 1971;16:817-22.
26. Worthington P, Evans JR. Controversies in oral and maxillofacial surgery. 1993; Founders.
27. Mehrabi M, Allen JM, Roser SM. Therapeutic agents in perioperative third molar surgical procedures. Oral Maxillofacial Surg Clin N Am. 2007;19:69-84.
28. Olusanya AA, Arotiba JT, Fasola OA, Akadiri AO. Prophylaxis versus pre-emptive antibiotics in third molar surgery: A randomised control study. Niger Postgrad Med J. 2011;18(2):105-10. PMID: 21670776.
29. Halpern LR, Dodson TB. Does prophylactic administration of systemic antibiotics prevent postoperative inflammatory complications after third molar surgery? J Oral Maxillofac Surg. 2007;65(2):177-85.
30. Ren YF, Malmstrom HS. Effectiveness of antibiotic prophylaxis in third molar surgery: a meta-analysis of randomised controlled clinical trials. J Oral Maxillofac Surg. 2007;65(10):1909-21.