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Comparative evaluation of antibiotic prophylaxis on pain, trismus and wound infection after third molar extractions

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Abstract

Introduction: Third molar extraction has been a frequent minor oral surgical procedure where antibiotic prophylaxis has always been a question of argument. Thus the study is aimed to prospectively evaluate and compare the role of preoperative and postoperative antibiotic therapy in the management of impacted mandibular third molars.

Material and methods: 100 selected patients were divided into 4 groups of 25 patients in each group. In Group A, no antibiotic was administered, in Group B only preoperative antibiotic was given. In Group C, patients received only postoperative antibiotic and in Group D patients received both preoperative and post operative antibiotic. The patients were evaluated on 1st, 4th and 7th postoperative days to assess the pain, swelling, trismus, dry socket and wound infection.

Results and conclusion: In our study we found that patients who received both pre and post operative antibiotics reported with minimum postoperative pain, swelling and trismus, followed by patients in who received only postoperative antibiotics & those who

received only preoperative antibiotics. Maximum post operative pain, swelling and trismus were seen in patients who did not receive antibiotics.

Keywords: Third molar extraction, impacted third molars, antibiotics, wound infection, dry socket

Introduction: Extraction of mandibular third molar is the most frequently performed minor oral surgical procedure by an oral and maxillofacial surgeon because of acute or chronic pericoronitis, periodontal problems, carious lesion on the second or third mandibular molar or cysts or tumours associated with third molars or prophylactically removed for orthodontic purposes[1]. Extraction of third molar is categorized as clean contaminated surgery, where a large amount of bacteria exists and the postoperative complications are usually associated with bacterial contamination and infection, it seems reasonable to prescribe antibiotic to prevent and reduce postoperative complications[2].The surgical access to third molar is gained through an incision followed by mucoperiosteal flap elevation, bone removal, tooth sectioning and elevation of the tooth. The incision and trauma of flap retraction results in post-traumatic inflammation i.e. pain, swelling, heat, redness and limitation of jaw opening[4].The facial swelling and trismus will reach their characteristic maximum 48 to 72 hours after surgery[5].

The infection risk for mandibular bony impactions is less than 5 %[6], probably reflective of the increased surgical trauma[7]. The organisms responsible for infections following third molar surgery are principally streptococci, anaerobic gram-positive cocci and anaerobic gram- negative rods. Although placement of antibiotics in the extraction socket and antiseptic mouthwashes have been shown to be partially effective in decreasing the rate of infection, systemic antibiotic administration remains the most common form of antibacterial prophylaxis employed[8]. Systemic antibiotics have been of suggested value for infection prevention in patients with gingivitis, pericoronitis, or general debilitating diseases but their effectiveness in reducing postoperative complications overall remains controversial[7].

There is no conclusive evidence in the benefit of routine use of antibiotics following third molar surgery. Antibiotics also present problems such as toxicity[11], allergy[11], secondary infections[11], and the development of resistance[11], diarrhoea[12], headache[12], gastrointestinal tract upset[4], colonization of resistant or fungal strains[4], increased risk of pregnancy in women taking contraceptive pills and increase in bleeding in patient taking warfarine, causes candidiasis and psuedomembranous colitis[13].

The theme of World health day 2011 is “Combat drug resistance, No action today, No cure tomorrow”[14].The goal of this study is to test the hypothesis whether antibiotic prophylaxsis can significantly reduce post operative complications like pain, swelling, trismus, alveolar osteitis, and infection following third molar surgery. The ideal antibiotic agent should be non-toxic, easy to administer and with as narrow a spectrum as necessary to eliminate infection[7].The antibiotic amoxicillin was used because of broad antibacterial spectrum, as reported in the British national formulary 53 it is first choice antibiotic for short term treatment of infection in the mouth[15].

Thus the aim of the study is to prospectively evaluate and compare the role of preoperative and postoperative antibiotic therapy in the management of impacted mandibular third molars. The objectives are:-

1. To assess the severity and duration of postoperative sequelae i.e pain, swelling and trismus.
2. To study the relative effectiveness of antibiotic in postoperative pain.
3. To evaluate the efficacy of antibiotic in reducing postoperative swelling.

4. To assess the role of antibiotic in reducing post operative trismus.
5. To evaluate the incidence of post operative wound infection and the efficacy of antibiotics in preventing wound infection.
6. To study the incidence of alveolar osteitis among the various groups.
7. To ascertain if a significant difference exists between various antibiotic protocols.
8. To propose a prophylactic protocol following surgical removal of mandibular third molars.

Material and methods: A Prospective randomized study was conducted in the department of oral and maxillofacial surgery to evaluate the role and protocol of antibiotic therapy in surgical removal of impacted mandibular third molars. Total 100 patients were divided into 4 groups. This study followed the Declaration of Helsinki on medical protocol and ethical Clearance was obtained from the Institutional Ethics Committee (Ref/PCDS/ACAD/8/2020-18/14) approval date - Dec 25, 2020). Informed written consent was obtained from the patients. The healthy patients with impacted mandibular third molars aged between 20 - 40 years were taken up for the study. Pregnant women, elderly patients, patient with any local infected third molars, and patient with anysystemic disease that compromises wound healing process were excluded from the study.

The 100 selected patients were divided into 4 groups of 25 patients in each group, the procedure using prepared randomizations in sealed envelopes.

Group A: Control group where no antibiotic (Preoperative, intraoperative or postoperative) was administered for the procedure.

Group B: Includes patients who received preoperative antibiotic prophylaxis of single dose Amoxicillin 2gms, orally, 1hr prior to the procedure. No intra-operative or post operative antibiotics given.

Group C: Includes patients who received postoperative antibiotic of amoxicillin 500mg, orally 3 times/day for 5 days after the procedure. No intraoperative or preoperative antibiotic given. inclusion of patients into the specific group was done randomly before the surgical

Group D: Includes patients who received both preoperative antibiotic prophylaxis of amoxicillin 2gms, orally, 1hr prior to the procedure and continued the same amoxicillin500mg tablets 3 times/day for 5 days after the procedure.

Surgical procedure*:* The extraction was performed under aseptic conditions. The surgical site was painted and draped. Inferior alveolar, lingual and buccal nerves were anesthetized using 3ml of local anesthesia with 2% lidocaine with 1:200,000 epinephrine. A vestibular triangular mucoperiosteal flap was raised with a distal incision and vestibular release. The osteotomy and odontectomy were done whenever necessary using a rounded and tapered tungsten carbide drill no-6 and 702 respectively, mounted in a hand piece, with abundant irrigation of saline. Extracting the tooth was followed by through lavage of the socket, haemostasis and flap closure using non-absorbable 3-0 silk suture that was removed after 7 days. Standard post operatives instructions were given to the patients and all the patients were recalled for evaluation.

All the patients were recalled 24hrs (1^{st}post operative day) after surgery, 4^{th} and 7^{th} postoperative days to assess the following clinical parameters:-

1) Pain scores were recorded 24hrs after surgery, 4^{th} and 7^{th} post-op days from 1 to 10 on a visual analog scale (VAS), in which the endpoints were marked “no pain” and “unbearable pain”.
2) Swelling (Inflammation) assessment was made by using the method described by **Amin and Laskin**. With a suture floss (00) tied to two mosquito forceps and with standard reference points. These determinations were repeated four times: immediately

before surgery, 24 hours after surgery, on 4th post operated day and on 7th day after surgery. The distances were measured as follows: The distance is measured in millimetres from the external palpebral angle to the goniac angle of the operated side known as angle of eye-angle of jaw (AE-AJ). The distance in millimetres from the lower margin of the tragus to the external angle of the buccal commissure known as tragus-angle of mouth (T-AM), and last, the distance from the lower margin of the tragus to the middle point of the symphysismenti, known as tragus-pogonion (T-P)[43].

3) Mouth Opening (Interincisal distance preoperatively and postoperatively). In order to assess the level of trismus, calibrated metallic scale was used to measure the interincisal distance. The measurements were done prior to surgery, 24 hours after surgery, 4th and 7th post op days.
4) Dry socket: The surgical site was evaluated for lack of a coagulam, exposed bone, necrotic and malodorous debris in the socket, extremely tender socket walls.
5) Infection of surgical site was assessed by following signs & symptoms: swelling, hyperaemia, prurulent drainage, fever, painfulness of mucosa in the region around the sutures[31,15].

- Post operative assessment :

Post-operatively patients were evaluated for:

- Pain: – After 1st, 4th day & 7th post op days.
- Trismus: - Before surgery, after 1st , 4th day & 7th post op days.
- Swelling: - After 1st, 4th day &7th post op days.
- Wound infection – 4th& 7th post op days.
- Alveolar osteitis – 2nd , 4th day & 7th post op days.

The cases which are diagnosed with alveolar osteitis / infection, recalled even after 7th post operative day and managed as per the protocol, on the basis of the above mentioned methods, the complete evaluation of the operative site was done and the data collected and subjected for statistically analysis.

Results: A total of 100 patients reporting with impacted mandibular third molar tooth were included in the study as per the inclusion and exclusion criteria.

The age ranged from 20 yrs to 40 yrs with the mean age of 27.08 years, 75% of the patients were of 3rd decade of life and 25% of the patients were of 4thdecade of life. 53% (53/100) were male and 47% (47/100) were female

Statistical Analysis: Kruskal-Wallis Test applied for the assessments of Pain, (one Way ANOVA) was applied for the assessment of swelling and trismus, Chi Square test was applied for the assessment of alveolar osteitis and wound infection.

All the patients were assessed for following five clinical signs:-Pain, swelling, trismus, alveolar osteitis and wound infection.

Pain: Maximum (mean) pain was recorded on 1st post operatively day and minimum on 7th postoperative day.

On 1st post operative day: Group A (score 10) displayed highest VAS Score followed by Group C, Group B and Group D respectively. Lowest VAS Score was displayed by Group B and Group C (Score 2).

On 4th post operative day: Group A (score 8) displayed highest VAS Score followed by Group C, Group B and Group D respectively. Lowest VAS Score was displayed by Group B and Group C (Score 0).

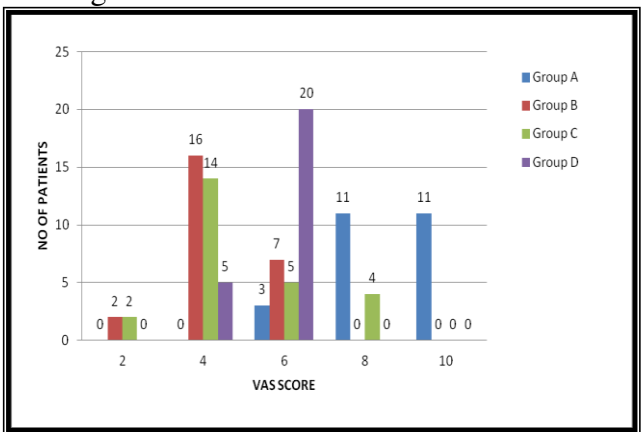
7th post operative day: Group A (score 2) displayed highest VAS Score followed by Group C, Group B and Group D respectively. Lowest VAS Score was displayed by Group B, Group C, Group D (Score 0).

Among all groups Kruskal-Wallis Test showed significant P value on 1st post operative day and 4th post operative day, while 7th post operative day showed insignificant value.

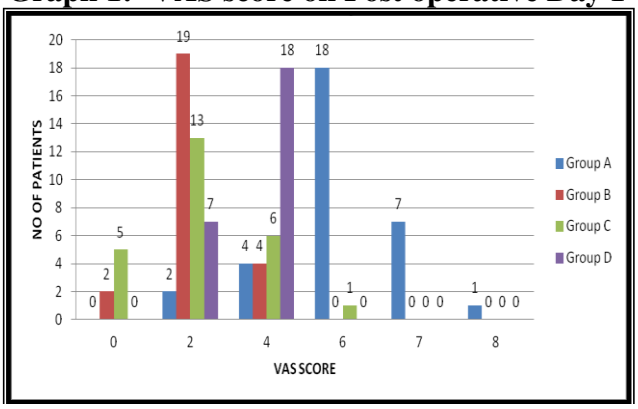
On 1st post operative day Mean pain recorded was minimum with Group D (30.7), followed by Group C (36), Group B (50.5) and Group A (84.8) respectively, and P value was <0.0001 that showed significant value.

4th post operative day Mean pain recorded was minimum with Group D (32.5), followed by Group C (35), Group B (55.1) and Group A (79.4) respectively, and P value was <0.0001 that showed significant value.

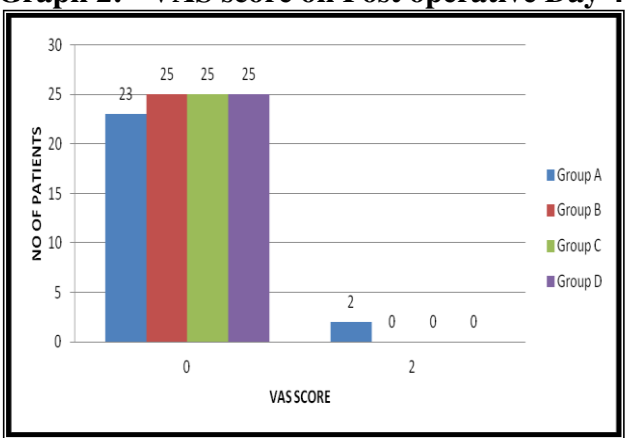
On 7th post operative day Mean pain recorded was minimum with Group D (49.5), followed by Group C (49.5), Group B (49.5) and Group A (53.5) respectively, and P value was 0.9484 that showed insignificant value.



Graph 1:- VAS score on Post operative Day 1



Graph 2:- VAS score on Post operative Day 4



Graph 3:- VAS score on Post operative Day 7

Swelling: Among all groups, maximum (mean) swelling recorded was on 1st post operatively day and minimum on 7th postoperative day.

Mean swelling recorded was minimum with Group D, followed by Group C, Group B and A respectively.

On 1st post operative day: Group A displaed Maximum (mean) swelling (12.51cm) followed by Group B, Group C and Group D respectively. Lowest VAS Score was displaed by Group D (11.96cm).

On 4th post operative day: Group B displaed Maximum (mean) swelling (12.24cm) followed by Group A, Group D and Group C respectively. Lowest VAS Score was displaed by Group C (11.76cm).

On 7th post operative day: Group B displaed Maximum (mean) swelling (12.13cm) followed by Group A, Group C and Group D respectively. Lowest VAS Score was displaed by Group D (11.6cm).

Among all groups (one Way ANOVA) test showed P value for 1st post operative day < 0.009, 4thpost operative day < 0.022, 7thpost operative day, < 0.040 respectively that showed significant values.

Table 1: Swelling presentation among different groups

Group	Day	Mean	SD	N	- Value ne way NOVA	-Value	Result
1st Day	Group A	12.51	0.395	25	4.097	0.009	S
	Group B	12.39	0.534	25			
	Group C	12.05	1.044	25			
	Group D	11.96	0.414	25			
4th Day	Group A	12.17	0.453	25	3.356	0.022	S
	Group B	12.24	0.551	25			
	Group C	11.76	1.072	25			
	Group D	11.8	0.410	25			
7th Day	Group A	12.13	0.526	25	2.871	0.040	S
	Group B	11.76	0.511	25			
	Group C	11.66	1.099	25			
	Group D	11.60	0.471	25			

Trismus: Among all groups, maximum (mean) mouth opening was recorded on 7thpost operative day and minimum on 1stpost operative day.

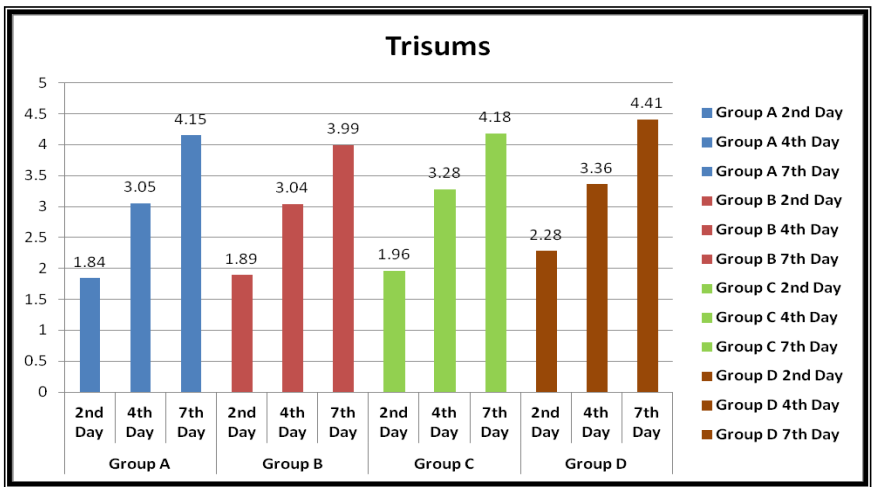
Mean Trismus recorded showed maximum mouth opening with Group D, followed by Group C, Group B and Group A respectively.

On 1st post operative day: Group D displaced Maximum (mean) mouth opening (2.28%) Followed by Group C, Group B, Group A respectively minimum (mean) mouth opening was in Group A (1.84%). \

On 4th post operative day: Group D displaced Maximum (mean) mouth opening (3.36%) Followed by Group C, Group B, Group A respectively minimum (mean) mouth opening was in Group A (3.04%).

On 7th post operative day: Group D displaced Maximum (mean) mouth opening (4.41%) Followed by Group C, Group B, Group A respectively minimum (mean) mouth opening was in Group A (3.99%).

Among all groups (one Way ANOVA) test showed P value for 1st post operative day 0.006, 4thpost operative day 0.026, 7thpost operative day, 0.006 respectively that showed significant values.

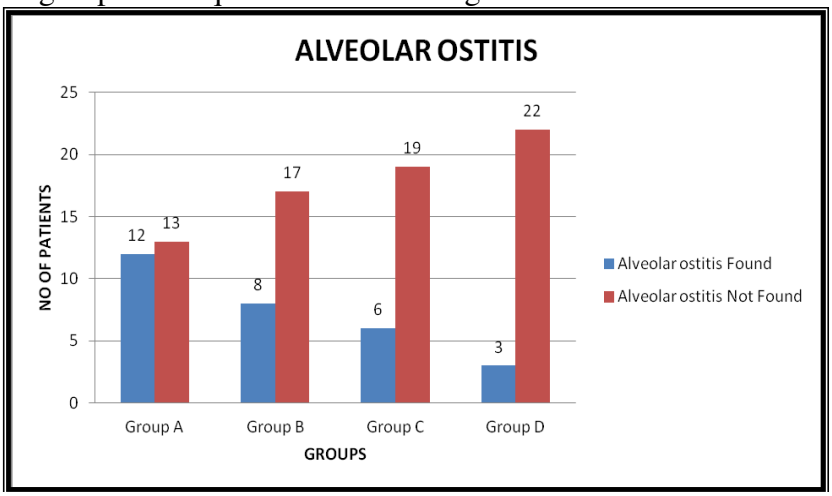


Graph 4:- Trismus recorded among different study groups

Alveolar osteitis: Alveolar osteitis was observed in 29% of cases. It was found to be maximum in Group A, followed by Group B , Group C and minimum in Group D.

Among all groups, AO recorded showed maximum in Group A about 48% of all the cases (12/25), followed by Group B 32% (8/25), Group C 24% (6/25) and minimum in Group D 12% (3/25).

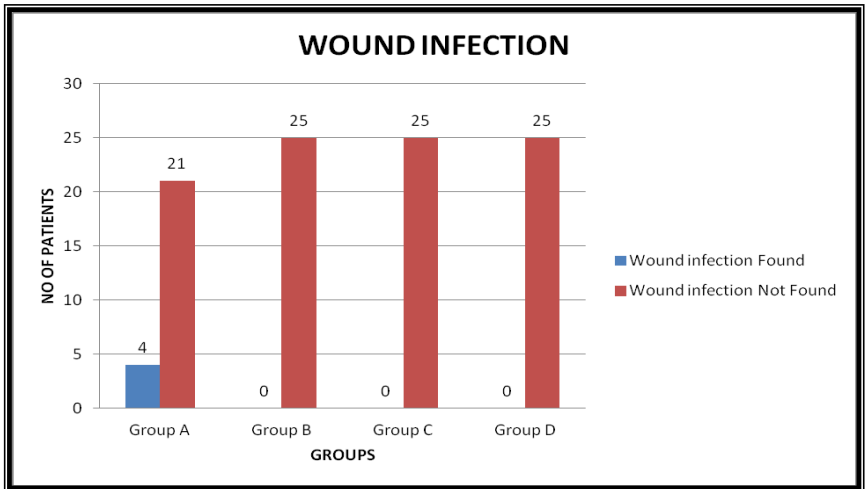
Among all groups Chi Square test showed significant P value <0.040.



Graph 5:- Comparision of alveolar osteitis amomg study groups

Wound infection: Among all groups, wound infection was observed in 4% of cases. It was only found in Group A (4/25) 16%, while in Group B, Group C and Group D none of the patients reported with infected socket.

Among all groups Chi Square test showed significant P value <0.006.



Graph 6:- Wound infection observed amomg study groups

Discussion: Controversies in antibiotic use for third molar surgery began during late **1960s** when **Killey, Steward & Kay, Howe, Thoma and Guralnick** supported the use of systemic antibiotics as routine prophylactic measure before removal of impacted mandibular third molar. However, the advice appeared to be based mainly on the clinical experience of these authors[38]. On the other hand **Kruger** and **Moore** rejected routine antibiotic prophylaxis condemning it as potentially harmful and without scientific evidence to support it[38].

In our study it was observed that patients who received both pre and post operative antibiotics reported with minimum postoperative pain, swelling and trismus, followed by patients in who received only postoperative antibiotics & those who received only preoperative antibiotics. Maximum post operative pain, swelling and trismus were seen in patients who did not receive antibiotics.

Arteagoitia et al (2005) in their unicentric, prospective, placebo controlled and double blinded study of 490 patients showed that postoperative treatment with Amoxicillin/clavulanic acid to prevent complications after third molar surgery was efficacious from statistical point of view. Since our study was a prospective randomized analysis, which included patients ranging from 20 to 40 years, we did not correlate our findings with the type of impaction and age.

In a similar study conducted by **Mac Gregor et al in 1980**, it was concluded that penicillin should be used justifiably in more difficult cases. However they failed to determine the difficulty criteria[34]. It is now an established fact that factors such as Interincisal opening, maxillomandibular jaw relationship, size of tongue, extensibility of lips and cheek, size of Rima Oris and overall patient cooperation play a vital role in determining the difficulty in extraction of impacted mandibular third molar. Thus, in our view, findings of **Arteagoitia et al (2005)[36]& Mac Gregor et al (1980)[34]** cannot be applied universally.

Josepth F Piecuch et al (1995) stated that "starting antibiotics after the surgery violates basic principles of prophylaxis". In their study it was concluded that systemic antibiotic use was of significance only in cases of partial or full bony mandibular third molar impactions. The authors did not support the use of systemic antibiotics following removal of fully erupted mandibular third molars[19].

In our study the cases were operated by different surgeons. Thus the possibility of interoperator variability bias cannot be ruled out. Unfortunately no study has been performed in the past which standardises these issues.

In our study comparison of postoperative pain, trismus and swelling was done on day 1, day 4 and day 7. The results of our study revealed that 11/25 patients (44%) who did not receive any antibiotics experienced maximum pain with VAS score of 10 followed by 11/25 patients (44%) with VAS score of 8 on 1st day. As far as patients who received preoperative antibiotics was concerned 7/25 patients (28%) experienced maximum pain with VAS score of 7. Among patients receiving postoperative antibiotics only 4/25 patients (16%) experienced maximum pain with VAS score of 8. However among patients receiving both pre and post operative antibiotics 20/25 patients (80%) experienced pain with maximum VAS score of 6. This shows that patients who received antibiotics either preoperatively, postoperatively or combination reported with a lower VAS score of pain on the 1stpost operative pain. A similar difference in the VAS score was noted on 4thpost operative day.

Interestingly on 7th postoperative day only 2/25 patients (8%) who did not receive any antibiotics reported a VAS score of 2. All the other patients in the other groups reported a VAS score of 0.

On examination of swelling it was revealed that maximum swelling was present in patients who did not receive any antibiotics (mean 12.51cms). Patients who received preoperative antibiotics (12.39 cms), those who received postoperative antibiotics (12.05) and those who received both pre and post operative antibiotics (11.96) reported marginally reduced swelling on 1stpost operative day. However on 7th postoperative day patients who received preoperative antibiotics reported with the maximum mean swelling of 12.05 cms. Negligible difference was found in facial swelling in those who did not receive any antibiotics (mean 11.76 cms), who received postoperative antibiotics (mean 11.66 cms) and who received both pre and post operative antibiotics (mean 11.6 cms) on 7thpost operative day.

Maximum (mean) Interincisal opening was seen in patients who received both pre and post operative antibiotics (2.28 cms) and minimum interincisal opening was present in there who did not receive any antibiotics (1.84 cms) on 1st postoperative day. Mouth opening in patients who received preoperative antibiotics and the patients who received postoperative antibiotics were intermediate (1.89 & 1.96 cms respectively) as compared to those who did not receive any antibiotics and in patients who received both pre and post operative antibiotics. However on 7thpost operative day the mean interincisal opening of those who did not receive any antibiotics was 3.99cms In patients who received preoperative antibiotics it was 4.15 cms, the patients who received postoperative antibiotics was 4.18 cms and in patients who received both pre and post operative antibiotics was 4.41 cms.

Our results suggest that patients who received antibiotics in any form whether preoperatively, postoperatively or combination, fared better for pain, swelling and trismus as compared to those in the patients who did not receive any antibiotics till the 4thpost operative day. However on 7th postoperative day differences in these symptoms were found at lowest level of significance among the various groups. These findings are similar to the findings of Bysteadt et al (1980)[11], Kaziro (1984)[34], Mac Gregor & Addy (1980)[34]&Kirnbauer et al. (2022) [44]

Alveolar osteitis was observed in a total of 29% (29/100) of cases. In patients who did not receive any antibiotics it was found in 48% (12/25), 32% (8/25) in patients who received preoperative antibiotics, 24% (6/25) in the patients who received postoperative antibiotics and 12% of cases (3/25) and in patients who received both pre and post operative antibiotics.

Wound infection was observed in 4% of cases. It was only found in patients who did not receive any antibiotics (4/25) 16%, while in all other patients, there was no report of infected socket.

Alveolar osteitis or dry socket is the sequelae most frequently and may involve 25% to 30% of the patients undergoing removal of impacted mandibular third molars**. Ren et al. (2007)** in a meta analysis concluded that antibiotics given 30 to 90 minutes before the first incision and continued 3 to 5 days after the surgery was a dosing strategy with the most predictable effectiveness for the prevention of alveolar osteitis and wound infections. A single dose of preoperative antibiotics was considered effective but less predictable[2].

Conclusion: Antibiotic therapy plays a positive role in the recovery of patients following surgical removal of impacted mandibular third molar teeth. Use of antibiotics in patients who received both pre and post operative antibiotics yielded the best overall results however, this modality involved quite a significant quantum of antibiotics which if used frequently may cause adverse effects for the patients, as reported in literature. Further studies are required to establish these facts.Use of a single dose pre operative antibiotic and post operative antibiotics showed similar processing results. In view of the practice practiced presently, this post operative antibiotic therapy is comfortable for the surgeons and patients. Further study is required to ascertain this claim. However, the single dose therapy promised better patient compliance and lesser drug load for the patient. The lack of antibiotics showed poor results and higher complication rates.

Based on the findings of this study, the author suggests a single dose preoperative antibiotic therapy for surgical removal of impacted mandibular third molar tooth as it is beneficial for the patients and the argument that antibiotics are not required is disputed.

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