



## Effectiveness of Antimicrobial Therapy after Extraction of Impacted Mandibular Third Molar: A Randomized Clinical Trial

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### ABSTRACT

**Aim:** The present study was conducted with the aim of evaluating the effectiveness of antimicrobial therapy following extraction of an impacted mandibular third molar.

**Materials and methods:** This randomized controlled trial was conducted on a total of 60 patients who were randomly assigned into three groups: Group I individuals were given 625 mg of combined amoxicillin and clavulanic acid tablet; 625 mg of combined amoxicillin and clavulanic acid tablet + 400 mg metronidazole tablet was given to group II individuals; whereas group III individuals were assigned no treatment. All the individuals underwent surgical extraction of impacted mandibular third molars under strict aseptic techniques, with minimal trauma to the surrounding tissues. Mouth opening in millimeters was recorded postoperatively using Vernier calipers on the 1st, 3rd, 5th, and 7th days. A 4-point visual analog scale (VAS) was used for assessing postoperative pain. Patient satisfaction was further assessed in a subjective manner using a graded scale from "very satisfied" to "very unsatisfied".

**Results:** The present study included individuals between the ages of 20 and 35 years. Group II individuals showed slightly

better satisfaction than the other group individuals. There was no statistically significant difference between the mean age of groups. It was observed that on day 3, the number of individuals with severe pain was slightly reduced in the group I compared with group III individuals. On day 5, participants with no pain were significantly more in group II followed by group I. Furthermore, there was a statistically significant difference between the study groups with respect to mouth opening on days 3 and 5.

**Conclusion:** It was concluded from this trial that the administration of postoperative antimicrobials showed no significant differences in the degree of postoperative complications that occur following the surgical extraction of impacted mandibular third molars.

**Clinical significance:** Antimicrobial drugs are routinely used to reduce the chances of surgical site infection, either preoperatively or postoperatively. Therefore, the clinicians should have sound knowledge about choosing the better antimicrobial drug after the extraction of impacted third molars.

**Keywords:** Antimicrobial therapy, Clinical trial, Mouth opening, Pain.

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### INTRODUCTION

One of the most frequently performed techniques in oral surgery is the surgical removal of an impacted mandibular third molar. It is also a fact that most often these surgeries are carried out with local anesthesia on an outpatient basis.<sup>1</sup>

Postoperative complications that have been found to be the most common are pain, trismus, and swelling.

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These complications affect the patients' quality-of-life in the first few days postoperatively. Infectious complications in the surgical extractions of mandibular third molars have been reported to range from 1 to 15%. Therefore, they are usually classified under the "clean-contaminated" group of surgeries.<sup>2</sup>

Antibiotic use under these situations has been well documented in the literature. Indications include infections caused by susceptible microorganisms that are identified, prophylaxis of clean-contaminated or contaminated surgeries, prevention of infection in immunocompromised patients, and also for the prevention of subacute bacterial endocarditis following intraoral procedures in total joint implantation patients. However, although the third molar surgery is generally considered clean-contaminated and occasionally contaminated surgery, the use of routine antibiotic prophylaxis in patients undergoing such surgeries is considered controversial.<sup>3</sup>

Scientific literature shows that numerous viewpoints have been put forth as a matter of debate, regarding the practice of antibiotic prophylaxis in third molar surgeries. Some authors have discussed that postsurgery complications are due to the trauma of the procedure itself and not due to the infectious events. Therefore, they do not consider antibiotics to be beneficial and so, advocate the use of anti-inflammatory drugs.<sup>4</sup>

It is observed that few authors also recommend the use of antibiotic prophylaxis for considerable reduction in postsurgical complications, such as trismus, pain, delayed wound healing, and swelling, whenever these symptoms are infection related.<sup>5</sup> Thus, the aim of the present study was to evaluate the effectiveness of different antimicrobial therapies following surgical extraction of an impacted mandibular third molar.

## MATERIALS AND METHODS

The present clinical study comprised 60 patients from the Department of Oral and Maxillofacial Surgery, Government Dental College, Thiruvananthapuram, Kerala, India. The inclusion criteria were that patients of age 20 to 35 years with similar impacted mandibular third molars were included. Patients allergic to penicillin, immunocompromised patients, those suffering from any other systemic disease, as well as pregnant women were excluded from the study. Ethical clearance for the conduct of the study was taken from the Institutional Ethical Board. Informed consent was also duly obtained from all the study participants.

### Surgical Procedure

All the patients underwent surgical extraction of the impacted mandibular third molars under strict aseptic

techniques. Care was taken to ensure that only very minimal trauma is caused to the surrounding tissues. Local anesthesia of 2% lignocaine with 1:200,000 adrenaline was used to administer the inferior alveolar, lingual, and long buccal nerve blocks.

A total of 60 patients were randomly allocated into three study groups comprising of 20 study individuals in each group. The study groups were as follows:

- *Group I:* 625 mg of combined amoxicillin and clavulanic acid tablet for 5 days
- *Group II:* 625 mg of combined amoxicillin and clavulanic acid tablet + 400 mg metronidazole tablet for 5 days
- *Group III:* No treatment.

Analgesics were prescribed in each of the three study groups. The individuals were examined for postoperative mouth opening (interincisal distance) on the 1st, 3rd, 5th, and 7th days postoperatively by a single examiner.

Vernier calipers were used to measure the postoperative mouth opening; it was recorded in millimeters on the 1st, 3rd, 5th, and 7th days following the surgical extraction of the impacted mandibular third molars. Postoperative pain was assessed using a 4-point VAS:

0 = Presence of no pain

1 = Presence of mild pain (pain reported only as response to questioning and without any behavioral signs)

2 = Presence of moderate pain (pain reported in response to questioning and also accompanied by signs or pain being reported spontaneously without any questioning)

3 = Presence of severe pain (eliciting a strong vocal response or a response that was accompanied by grimaces, withdrawal of the arm, or tears).

A graded scale from "very satisfied" to "very unsatisfied" was used to assess patient satisfaction subjectively.

Analysis of the collected data was done using Statistical Package for the Social Sciences software version 20.0. Quantitative data were analyzed using t-test, whereas Fischer exact test was used for analysis of qualitative data;  $p < 0.05$  was considered as statistically significant.

## RESULTS

Table 1 depicts the mean age comparison among the three study groups. The present study comprised 20- to 35-year-old patients. The mean age among group III study individuals was  $33.20 \pm 1.80$  years, which was slightly more than the mean age of groups I and II ( $29.10 \pm 1.29$  years and  $32.30 \pm 2.40$  years respectively). However, there was no statistically significant difference between the mean ages of all the three study groups.

**Table 1:** Mean age comparison among study groups

Groups	n	Mean ± SD	t-value	p-value
I	20	29.10 ± 1.29	2.427	0.216
II	20	32.30 ± 2.40		
III	20	33.20 ± 1.80		

SD: Standard deviation

**Table 2:** Assessment of patient's overall satisfaction

	Patient satisfaction level			
	Very satisfied	Fairly satisfied	Fairly unsatisfied	Very unsatisfied
Group I (n = 20)	10	6	3	1
Group II (n = 20)	12	6	1	1
Group III (n = 20)	11	5	2	2

$\chi^2 = 1.244, p = 0.512$

**Table 3:** Assessment of pain VAS among different groups

Duration	Groups	No pain	Mild pain	Moderate pain	Severe pain	Fischer exact test
Day 1	I	0	10	7	3	$\chi^2 = 6.110, p = 0.212$
	II	0	11	8	2	
	III	0	10	7	3	
Day 3	I	0	12	7	1	$\chi^2 = 10.168, p = 0.124$
	II	0	13	7	0	
	III	0	10	8	2	
Day 5	I	3	12	5	0	$\chi^2 = 10.461, p = 0.042^*$
	II	5	14	1	0	
	III	2	11	6	1	
Day 7	I	12	6	2	0	$\chi^2 = 6.512, p = 0.523$
	II	14	6	0	0	
	III	10	5	5	0	

\*Statistically significant

It is observed that group II study individuals show slightly better satisfaction than the study individuals of other groups when compared for patient satisfaction level. Furthermore, there was no statistically significant difference between the mean ages of all study groups (Table 2).

As seen in Table 3, the severity of pain recorded using VAS score showed no statistically significant differences between all the study groups on day 1. However, the number of study individuals with severe pain was observed to be more in groups I and III. On day 3, the number of study individuals with severe pain was slightly reduced in group I as compared with group III. On day 5, patients with no pain were more in group II followed by group I, which was statistically significant. The pain was completely reduced on the 7th day in all the three study groups.

The mouth opening on the 1st, 3rd, 5th, and 7th days was slightly more in group II study individuals (23.22 ± 1.19, 28.44 ± 1.10, 34.65 ± 1.22, and 34.92 ± 0.86 mm respectively). A statistically significant difference was observed between the study groups on days 3 and 5 (Table 4).

**DISCUSSION**

With regard to the occurrence of infections following the removal of the third molars, the microorganisms that are most frequently isolated include *Streptococci*, anaerobic Gram-positive cocci, and anaerobic Gram-negative rods. The antibiotic agent used for effective prophylaxis

**Table 4:** Assessment of mouth opening among different groups

Duration	Groups	Mean ± SD	t-value	p-value
Day 1	I	22.12 ± 1.50	0.846	0.476
	II	23.22 ± 1.19		
	III	22.40 ± 1.60		
Day 3	I	26.10 ± 1.42	5.345	0.011*
	II	28.44 ± 1.10		
	III	25.18 ± 1.86		
Day 5	I	32.22 ± 1.72	6.204	0.032*
	II	34.65 ± 1.22		
	III	29.10 ± 1.08		
Day 7	I	34.88 ± 1.22	2.464	0.381
	II	34.92 ± 0.86		
	III	32.32 ± 0.16		

\*Statistically significant; SD: Standard deviation

should be widely distributed in the body fluids, must have good bone penetrance, as well as be active against the microorganisms.<sup>6</sup>

The authors observed that many reports in the previously published literature have explored the efficacy of antibiotics in reducing postoperative pain, trismus, and edema. Their results were found to favor aspects, such as an aseptic surgical site and an established technique aiming to minimize trauma.<sup>7</sup> Within the oral cavity, patient and operative characteristics may influence the risk of development of postoperative infection. It has been widely accepted that age, nutritional status, diabetes, smoking, obesity, coexisting infections elsewhere in the body, colonization with pathogens, and a compromised

immune response are the factors that increase the possibility of postoperative infection.<sup>8</sup>

Ness and Peterson<sup>9</sup> have set forth certain criteria when choosing an antibiotic for prophylaxis, advocating prescription of the correct antibiotic with the narrowest antibacterial spectrum. Further, it was recommended that a high enough dosage must be administered at the most appropriate time, with the shortest exposure. In dentistry, the gold standard for the treatment of infections, or as prophylaxis, has been amoxicillin. It has been found to be highly efficacious against Gram-positive *Streptococcus* and *Staphylococcus* species, as well as against several Gram-negative bacteria, which are common oral infection isolates.<sup>10</sup> Factors, such as good absorption in the gastrointestinal tract coupled with the capacity of reaching quick and effective concentrations at the target site are responsible for amoxicillin being the antibiotic of choice.<sup>11</sup>

In the present study, there was no statistically significant difference in patient satisfaction between the individuals of all the three study groups. According to Balaguer-Martí et al,<sup>12</sup> patient satisfaction also depends on the efficiency of the surgeon as well as the clarity of the clinical information that has been provided about the surgical procedure.

Trismus that has resulted as a sequel to inflammation settles by itself in time, not needing any intervention. On the contrary, trismus prolongs for a longer duration and, worse still, it may even exacerbate when there is an infection. This complication can be limited by prescribing appropriate antibiotics.<sup>13</sup>

When the preoperative and postoperative measurements were compared, in most of the previous studies, the antibiotics which were used postoperatively did not differ significantly in their effects when prescribed for decreased maximal opening of mouth.<sup>14</sup>

The present study shows that there was a statistically significant difference between the study groups with regard to mouth opening, on day 3 and 5. Patients with no pain were significantly more in group II followed by group I on day 5. In contrast to the studies done by Sekhar et al<sup>15</sup> and Kaczmarzyk et al,<sup>16</sup> no statistically significant difference was found among the study groups in terms of pain and mouth opening. Therefore, routine prescription and the use of preoperative or postoperative antibiotics during extraction of the third molars fail to show any advantage.

In the present study, the presence of postoperative pain was found to be in contrast with the findings of Moore and Hersh<sup>17</sup> and Beirne and Hollander.<sup>18</sup> It is believed that pain following the third molar surgery correlates in intensity with the process of inflammation. This is, in turn, dependent on factors, such as preexisting infection, duration of extraction, level of difficulty of

the extraction, surgeon's experience, and technique of extraction among other things.

The present study was focused predominantly on the assessment of postoperative clinical infection including its sequelae, namely, pain and mouth opening, and its association with factors, such as the microbial load at the operated site and patient satisfaction. In the present study, there were no cases of active pus discharge or abscess formation requiring incision and drainage. Gram-negative bacteria like *Pseudomonas* and *Enterobacteria* like *Escherichia coli* were the major isolates from the aspirates of suture sites. It may be noted that the sample contamination during collection, or further still, the combined use of amoxicillin and clavulanic acid effective against Gram-positive bacteria could be the reason for the presence of Gram-negative bacteria.

Factors, such as less virulent strains of bacteria and low bacterial colony count insufficient to overcome the host resistance to cause infection are sufficient to explain the presence of these Gram-negative bacteria in the absence of infection clinically.<sup>5</sup>

The use of antibiotics in the prophylactic therapy against potential infections has been a conventional practice in third molar surgery. The topic of using antibiotics prophylactically during the third molar surgery has repeatedly been debated.<sup>19</sup>

Various conclusions have been derived so far in this regard, with many found to be conflicting, from the previously conducted randomized controlled clinical trials. This has resulted in long-established uncertainties, still continuing in clinical practice, among both those for and against antibiotic prophylaxis—each having put forth their respective substantiated documentations.<sup>20</sup>

Postoperative complication occurs due to many factors, while the selection of an appropriate antibiotic is also highly influenced by the type of bacteria present at the operative site. Therefore, selecting the best antimicrobial drug and the time of administration are very important after the extraction of impacted third molars.

## CONCLUSION

The present study concluded that there were no significant differences in the degree of postoperative sequelae that occurred following the extraction of impacted mandibular third molar, due to the administration of antimicrobials postoperatively.

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