Is Post-Operative Antibiotic Therapy Justified for Surgical Removal of Mandibular Third Molar? A Comparative Study

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Abstract Surgical removal of impacted mandibular third molar (SRIMTM) is the most common procedure performed in oral and maxillofacial surgery. In the literature, many complications associated with lower third molar removal are described such as pain, swelling, trismus, infection, inflammation, and nerve damage. Antibiotics are routinely used either pre-operatively or post-operatively to reduce the chances of surgical site infection (SSI). However routine use of antibiotics for SRIMTM is still controversial. For antibiotics to be effective in reducing post-operative infective complications, the time of administration is very important. Adequate serum concentration of antibiotic must be achieved prior to the procedure. In a developing country like India, antibiotics are routinely prescribed post-operatively. The current study is designed to evaluate the efficacy of post-operative prophylactic antibiotic in SRIMTM.

Keywords Impacted mandibular third molar · Post-operative prophylactic antibiotic · Surgical site infection

Introduction

The surgical removal of impacted mandibular third molar (SRIMTM) is one of the most common procedures performed in oral and maxillofacial surgery. Antibiotics are routinely prescribed to reduce the post-operative complications associated with SRIMTM. The use of antibiotic therapy without appropriate indications can result in adverse outcomes such as development of resistant organisms, secondary infection, toxicity of the antibiotics, and development of allergic reactions [1, 2]. It is estimated that 6–7 % of patients receiving antibiotics experience some kind of adverse reaction [3]. Thus for the usage of antibiotic routinely for SRIMTM in asymptomatic patients, its advantages must exceed the risk of its adverse outcomes. The purpose of this article is to evaluate the appropriateness of the routine use of antibiotics for third molar surgery.

Materials and Method

Authors function as consultant maxillofacial surgeons in many major hospitals in the city of Pune (Maharashtra, India). These tertiary referral centers for specialty cases drain a large area of western Maharashtra. The study was carried out as an open clinical trial on 50 patients chosen from the ones referred to our Oral & Maxillofacial Surgery Centre for SRIMTM (29 males & 21 females) during a period of 3 months. The mean age of patient was 30 years (age range, 20–40 years). Institutional review board approval was obtained prior to the commencement of study. Informed written consent was obtained from all the patients. Inclusion criteria were (1) patients above 18 years of age (2) patients with partially bony impacted mandibular third molar with or without pericoronitis or caries

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Fig. 1 VAS scale to evaluate pain reference values given to patients. **A** Score 0—no pain, patient feels well. **B** Score 1—slight pain. If the patient is distracted he/she does not feel pain. **C** Score 2—mild pain. The patient feels pain even if concentrating on some activity. **D** Score 3—severe pain. The patient is very disturbed but nevertheless can continue with normal activities. **E** Score 4—very severe pain. The patient is forced to abandon normal activities. **F** Score 5—extremely severe pain. The patient must abandon every type of activity and feel the need to lie down

(3) patients not receiving any antimicrobial medication for at least 6 weeks prior to SRIMTM. Exclusion criteria were (1) patients allergic to Penicillin & allergic to standard set of medication given post-operatively (2) immunocompromised & systemically compromised patients (3) patients having local pathology such as cyst or tumor associated with impacted mandibular third molar (4) patients with previously radiated maxillofacial region (5) patients having received antibiotics for recent systemic infection 6 weeks prior to surgery (6) mentally challenged patients (7) patients unable to come for follow-up visits. Two groups were established and the patients were randomly divided (25 in each group) into either of the two groups. In the first group post-operative antibiotic treatment was administered with Tab Augmentin 625 mg (Amoxicillin trihydrate 500 mg + Potassium clavulanate, GlaxoSmithKline). The second group received no antibiotic medication and served as the control group. Pre-surgical evaluation of pain, swelling, lymphadenopathy, pyrexia and purulent discharge from the surgical site were made. Laboratory investigations such as complete hemogram, bleeding time, clotting time, prothrombin time, random blood sugar level & routine urine were carried out on all patients. All patients were followed-up clinically for a minimum period of 10 days post-operatively. Evaluation for pyrexia, purulent discharge from surgical site, persistent pain &/or swelling & lymphadenopathy was done on 1st, 3rd, 7th and 10th post-operative day. Pain was quantified subjectively using a visual analogue scale (VAS) (Fig 1) [4]. Increase in pain from 3rd to 10th day post-operatively was considered as infective in nature. Swelling was measured using a horizontal and vertical guide with a flexible ruler [5]. The

horizontal measure being the distance between the oral commissure and the lowest part of ear lobe & the vertical being the distance between the external canthus of the eye and the angle of the mandible. The average of the two determined the facial measurement (Fig 2). Swelling not commensurating with the inflicted surgical injury or showing increase, &/or not diminishing between 4th to 10th day post-operatively was considered as infective in nature. Axillary temperature was measured with a digital thermometer (Hangzhou Medical Digital Thermometer) [6]. Temperature of 100.4° F or more, at any given time between 4th to 10th day post-operatively and not attributable to any other systemic condition was considered as

Fig. 2 Vertical and horizontal measurement to determine facial measurement. **A** Vertical measure corresponds to the measure between the external canthus of the eye and the angle of the mandible. **B** Horizontal measure corresponds to the measure between the commissure and the ear lobe

Table 1 Evaluation of pain score (VAS) in Group I

SI No.	Score on post-operative day			
	Day 1	Day 3	Day 7	Day 10
1.	4	3	2	0
2.	4	2	1	0
3.	3	2	1	0
4.	4	3	1	0
5.	4	1	0	0
6.	4	2	1	0
7.	3	1	0	0
8.	3	2	0	0
9.	3	1	0	0
10.	4	3	2	0
11.	4	3	2	1
12.	5	3	2	1
13.	4	2	1	0
14.	3	1	0	0
15.	4	2	1	0
16.	4	3	4	3
17.	2	1	0	0
18.	4	2	1	0
19.	3	2	1	1
20.	4	3	1	0
21.	4	3	1	0
22.	4	3	1	0
23.	5	3	2	1
24.	3	1	0	0
25.	4	3	1	0

Table 2 Evaluation of pain score (VAS) in Group II

SI No.	Post-operative day			
	Day 1	Day 3	Day 7	Day 10
1.	4	3	2	0
2.	4	2	1	0
3.	3	2	1	0
4.	4	3	1	0
5.	4	1	0	0
6.	4	2	1	0
7.	3	1	0	0
8.	3	2	0	0
9.	3	1	0	0
10.	4	3	2	0
11.	4	3	2	1
12.	5	3	2	1
13.	4	2	1	0
14.	3	1	0	0
15.	4	2	1	0
16.	3	2	1	0
17.	2	1	0	0
18.	4	2	1	0
19.	3	2	1	1
20.	4	3	1	0
21.	4	3	1	0
22.	5	4	3	1
23.	4	2	1	0
24.	3	2	1	0
25.	3	1	0	0

pyrexia due to SSI. Purulent discharge from surgical site and lymphadenopathy seen between 4 to 10 days was considered as infective in nature. All surgical procedures for removal of impacted third molar were performed under local anesthesia by the same surgeon following the standard protocol of asepsis and surgery under local anesthesia. “Terrance Ward” incision was used in all the cases [7] Constant copious irrigation with refrigerated saline was used during the bone removal and odontectomy to prevent thermal necrosis. Sectioning of the tooth was done when indicated. Primary closure was accomplished using a 3-0 Mersilk (Johnson and Johnson, Manufacturer product code:W502H) after hemostasis. Pom-pom was used as a pressure pack post-operatively. Surgical time was calculated from placement of incision to the last suture given. All patients received same set of post-operative medications (Tab. Diclofenac sodium (50 mg) TID, Tab. Ranitidine 150 mg BID for 5 days) and set of instructions. Any evidence of infection seen on the follow-up visits was managed either medically by starting appropriate antibiotics or surgically by removal of sutures for drainage and dressing, depending on the severity of the infection.

Results

No severe complications like persistent pain and swelling, fever, lymphadenopathy and purulent discharge (to suggest SSI) were seen in any patient in any group. The results for each parameter in each group are given in tables mentioned. Wilcoxon signed rank test was used to compare pain score on different post-operative days. Statistical analysis showed highly significant ($P < 0.001$) decrease in the amount of pain from the 1st to 10th day post-operatively in both the groups (Tables 1, 2). Paired t test was used for statistical analysis of facial measurement on the 1st, 3rd, 7th and 10th days post-operative with the pre-operative measurement. In both the groups analysis showed that there was a significant increase in facial measurement till the third post-operative day. From the third day onwards there was a remarkable decrease in swelling (Tables 3, 4). The measurement on the 10th day was comparable to pre-operative measurement in both the groups. Pyrexia, purulent discharge from surgical site, persistent pain and swelling with lymphadenopathy were not seen in any patient in any group (Table 5). Thus, there was not a single case of SSI in both the groups.

Table 3 Evaluation of facial measurement (in mm) in Group I

SI No.	Pre-op	Post-operative day			
		Day 1	Day 3	Day 7	Day 10
1.	104	108	107	105	103
2.	117	120	119	118	116
3.	105	112	110	108	106
4.	105	110	109	108	106
5.	112	116	115	113	110
6.	107	110	109	108	106
7.	105	110	108	106	104
8.	103	106	105	104	102
9.	101	104	103	101	100
10.	99	103	102	100	98
11.	100	107	105	103	101
12.	121	128	127	124	120
13.	103	110	109	107	105
14.	113	119	117	116	114
15.	109	114	112	110	108
16.	106	112	112	110	107
17.	113	117	116	114	112
18.	100	106	103	100	99
19.	119	125	123	120	118
20.	97	105	103	100	98
21.	107	112	111	109	107
22.	107	115	113	110	106
23.	104	111	110	107	103
24.	92	100	98	96	93
25.	93	100	97	95	94

Table 4 Evaluation of facial measurement (in mm) in Group II

SI No.	Pre-op	Post-operative day			
		Day 1	Day 3	Day 7	Day 10
1.	109	114	113	111	110
2.	95	102	100	97	96
3.	107	113	111	108	107
4.	107	115	112	111	108
5.	97	103	101	99	98
6.	99	106	104	103	102
7.	101	106	104	102	100
8.	98	102	101	99	97
9.	104	108	106	105	103
10.	96	100	98	97	96
11.	98	104	102	100	99
12.	100	106	104	103	99
13.	98	104	102	100	99
14.	105	108	107	106	104
15.	102	106	104	103	101
16.	96	102	100	98	97
17.	106	110	108	107	105
18.	108	112	110	109	108
19.	98	102	100	99	97
20.	104	108	106	105	103
21.	102	106	104	103	101
22.	96	102	100	98	96
23.	111	119	118	115	113
24.	101	107	105	103	101
25.	103	110	108	106	104

Discussion

Surgical removal of impacted mandibular third molar is usually carried out in a clean and contaminated environment where a large amount of bacteria exist and infective post-operative complications are usually associated with bacterial contamination. For antibiotics to be effective in reducing SSI, the timing of its administration is very important. Mehran Mehrabi, John M. Allen, Steven M. Roser [8] concluded that the risk of post-operative infection in clean and contaminated wound, such as surgical removal of impacted third molar is around 10 % and that for contaminated and dirty wounds is between 20–40 %. Thus antibiotic prophylaxis is recommended for clean-contaminated, contaminated and dirty wounds. Adequate minimum inhibitory concentration (MIC) levels of antibiotic must be achieved before the first incision is made to allow its effect on microbes that contaminate the surgical wounds and blood clots. This requires that the antibiotic be given ~1 h before the procedure [9, 10]. However some authors are of the opinion that the incidence of

post-operative infections after SRIMTM (1–5 %) is too low to justify routine antibiotics [11]. The blind use of antimicrobials can result in adverse outcomes, and there is a general trend to overprescribe antimicrobials [12].

Curran et al. [13], in their series, compared antibiotic therapy with no antibiotic therapy and found no difference regarding post-operative infections. Two literature reviews by MacGregor [14] and Sands et al. [15] did not recommend the routine administration of antibiotics for third molar surgery, except for the most difficult cases. The risks of indiscriminate prescribing include development of resistant organisms, secondary infection, toxicity, and the development of allergic reactions [1]. It is estimated that 6–7 % of patients who are given antibiotics have some kind of adverse reaction [6]. The estimated rate of infection after removal of an impacted third molar is <1 %, so the usage of such drugs is questionable [13, 16]. An important point in the debate about usage of prophylactic antibiotics is its timing of administration. There is significant evidence that giving antibiotics preoperatively may reduce the incidence of post-operative wound infections [17].

Table 5 Evaluation of fever, lymphadenopathy and purulent discharge in Groups I & II on 1st, 3rd, 7th and 10th post-operative day

SI No.	Complications	Day 1		Day 3		Day 7		Day 10	
		Group		Group		Group		Group	
		I n = 25	II n = 25	I n = 25	II n = 25	I n = 25	II n = 25	I n = 25	II n = 25
1.	Fever (F)	A	A	A	A	A	A	A	A
2.	Lymphadenopathy	A	A	A	A	A	A	A	A
3.	Purulent discharge	A	A	A	A	A	A	A	A

A absent

Ren [18] reviewed 12 published clinical trials on 2396 patients for the effectiveness of antibiotic prophylaxis. 1,110 subjects received prophylactic systemic antibiotics and 1,286 subjects received placebo. Post-operative SSI occurred in 4 % of antibiotic group and 6.1 % in placebo group. In another similar study on 118 subjects (59 antibiotic and 59 placebo group) by Halpern [19] there was no post-operative inflammatory complication in subjects who received intravenous Penicillin or Clindamycin 1 h before the procedure but in placebo group, SSI was seen in 8.5 % of the subjects. Classen et al. [20] in his randomized prospective trial carried out on 2,847 patients, in the first group where antibiotic was given 2–24 h prior to surgery (n-369) the SSI was 6.7 %. In the second group where the antibiotic was administered within 2 h before the surgery (n-1708) the SSI was 1 %. In the third group where antibiotics were administered perioperatively (n-282) the SSI was 2.4 %, and in the fourth group which received antibiotics only post-operatively, the SSI was 5.8 %. The highest rate of infection occurred in the group that received antibiotic therapy more than 3 h before the surgery followed by the group that received antibiotic post-operatively. It is suggested that if antibiotic is to be given, then the ideal timing for its administration is 30 min to 2 h prior to surgery with additional coverage extending for one to two and a half, half lives of the prescribed antibiotic for the length of the operation [21]. Poeschl et al. [22] from their study concluded that specific post-operative oral prophylactic antibiotic treatment after the removal of lower third molars does not contribute to a better wound healing, less pain, or increased mouth opening and could not prevent the cases of inflammatory problems after surgery, respectively, and therefore is not recommended for routine use.

Conclusion

In our study there was no case of infection seen in either of the two groups. This study suggests that antibiotics should be used reasonably and only if the surgeon feels the need to do so. From the results obtained in our study, we do not

recommend the routine and indiscriminate use of antibiotics for surgical removal of asymptomatic impacted mandibular third molar. In a developing country like India this may benefit the patient in reducing the expenses procured during surgery. The surgeon must consider all potential factors that may contribute to the post-operative complication and decide whether the benefits of antibiotic therapy outweigh its risks before prescribing an antibiotic for SRIMTM.

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Conflict Of Interest Nil

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