Rationale of Antibiotic Usage in Simple Exodontia – a Prospective Study

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Abstract- Antibiotic prescription after simple extraction of tooth has remained a controversial topic amongst dental fraternity owing to the fact that antibiotic resistance is becoming a serious public health and patient safety issue. A prospective clinical trial was undertaken to assess the rationale behind antibiotic use after simple extractions in minimizing post extraction pain and discomfort. *Materials and methods*: All the patients undergoing simple extractions were categorized into two groups: Group 1: patients receiving antibiotics postoperatively, Group 2: patients not receiving antibiotics postextraction. The patients were evaluated upto 6 postextraction days for signs of infection and dry socket. *Results:* 4 patients (1.2%) reported with infection of the extraction socket in nonantibiotic group, whereas 1 (0.3%) case of infection was found in the antibiotic group. Dry socket was seen in 29 (8.8%) patients, 16 (4.8%) in the antibiotic group and 13 (3.9%) in the nonantibiotic group. *Conclusion*: The results of the present study do not significantly justify the use of antibiotics following extractions.

Index Terms- antibiotic resistance, dry socket, infection.

Declarations of Interest: None.

I. INTRODUCTION

A major turning point in medicine, as well as in human history was the discovery of antibiotics in the early 20th century. Unfortunately, development of resistance turned out to be a serious consequence of the use of these lifesaving and wondrous medicines. Bacterial resistance to antibiotics is multifactorial. In medicine, long-term and repetitive use of broad-spectrum antibiotics has resulted in antibiotic resistance. Some resistance occurs intrinsically, but much of the blame is attributable to decades of use by medical practitioners, nontherapeutic use in agriculture, and careless disposal of waste by the pharmaceutical industry as a whole [1].

Antibiotics used in dentistry are frequently broad-spectrum agents, which can predispose for the selection of resistant strains. Furthermore, there is evidence that antibiotic-resistant bacteria, such as the *Prevotella* species, are being isolated from odontogenic infections with increasing frequency[2]. Antibiotic resistance is a serious public health and patient safety issue. Antibiotic resistant infections are extremely difficult to treat and frequently recur[1]. The indiscriminate use of antibiotics may promote the emergence of antibiotic resistant bacterial strains, increases the likelihood of preventable adverse reactions, and represents a waste of healthcare resources[2]. This problem has proved to be unrelenting and a constant source of frustration for researchers, health care providers as well as patients[1].

Of the total antibacterial prescriptions, dental prescriptions contribute upto 7–9% in primary care [1,3]. This doubly emphasizes the responsibility of dental surgeons on curbing the practice of routine antibiotic prophylaxis and practicing selective antibiotic use. Varied schools of thought exist among dental academia regarding prescription of antibiotics after simple tooth extraction. Although bacteremia occurs during simple exodontia[1,4], this doesnot justify antibiotic use in a healthy individual, as the effective host response can sufficiently counteract it. The current trend in dentistry in the developed world is shifting to the notion that antibiotics are not justified following simple exodontia. Unfortunately not much focus is laid on this aspect in the developing world where standards of oral care are far below those in the developed world[1,5].

The aim of the present study is to determine the rationality for postoperative antibiotic use following simple exodontia and assessing its efficacy in minimizing postoperative patient discomfort and complications

II. MATERIALS AND METHODS

A prospective randomized double-blind placebo-controlled clinical trial study was designed wherein all healthy males and females who reported to the Department of Oral and Maxillofacial Surgery, Government Dental College and Hospital, Hyderabad, India and undergoing simple tooth extractions from January 2019 till March 2019 were included in the study.

Inclusion criteria were as follows: (1) both male and female patients; (2) patients aged between 15 and 80 years; (3) patients with a good systemic health; (4) patients undergoing simple extractions of permanent mandibular and/or maxillary teeth ; (6) patients undergoing single tooth extractions; (7) extractions requiring minimal instrumentation.

Exclusion criteria were as follows: (1) patients undergoing surgical extractions; (2) patients with deciduous teeth or teeth associated with local pathology; (3) patients with impacted mandibular third molars; (4) patients with a debilitating systemic disease; (5) patients undergoing extractions of endodontically treated teeth; (6) patients currently taking antibiotics at the time of extraction or have had antibiotics less than 3 days prior to extraction; (7) patients with habits which are known to be detrimental to oral health such as smoking, pan, betel nut, and/or tobaccochewing; (8) patients presenting with acute infections; (9) pregnant patients (10) inability to appear for follow-up.

All patients who fulfilled the inclusion criteria, after approval by the Institutional Ethical Review Committee were included in this study. All extractions were performed in the oral surgery department at Government Dental College and hospital, Hyderabad by senior dental surgeons (residents) under strict aseptic conditions using the following surgical protocol: regular surgical gloves and masks were worn for every extraction; 2% lignocaine containing 1 : 80,000 adrenaline were administered using 25/27 gauge needle prior to extraction; inferior alveolar nerve block was used for mandibular molars and premolars and local infiltration was used for mandibular anterior teeth and all maxillary teeth.

All the patients undergoing simple extractions were randomly categorized into two groups:
Group 1: patients receiving postextraction antibiotics.
Group 2: patients not receiving postextraction antibiotics.
Group 1: Patients Receiving Postextraction Antibiotics. All patients in this group were prescribed amoxicillin 500mg 8 hourly for 5 days along with Diclofenac sodium 75mg 8 hourly for 3 days starting 30 minutes after the extraction.
Group 2: Patients Not Receiving Postextraction Antibiotics. All patients in this group were not prescribed antibiotic and were given Diclofenac sodium 75mg 8 hourly for 3 days starting 30 minutes after the extraction.

Randomization was achieved using the closed envelope technique. In this randomization technique, dental surgeons were given randomly generated prescription regimen within sealed opaque envelopes. After establishing consent, the envelope was opened and the patient was then offered the allocated prescription regimen.

Extractions were performed with minimal invasion using a mucoperiosteal elevator, straight elevator (if required), and forceps. After achieving hemostasis using a cotton pressure pack, postoperative instructions were given to every patient. Patients were recalled after five days to assess postoperative complications including inflammation, wound infection, and dry socket. Intensity of pain (Fig. 1) was evaluated in preoperative and postoperative session using Visual Analogue Scale (VAS) of 10 cm horizontal line where the end points were marked as no pain and unbearable pain. Patients were asked to indicate on the line at a point which corresponds to the level of pain intensity he/she feels.

On recall, patients were evaluated for signs of persistent inflammation (i.e., degree of pain, swelling, and redness) and signs of dry socket (i.e., severe pain accompanied with presence of denuded bone at the base of the socket). Presence of persistent inflammation and/or suppuration on the 6th day was considered as wound infection.

Photographs were also taken preoperatively and during each follow-up session to document the outcome.

The data were entered into the computer for analysis with the help of software program SPSS version 16 for windows. The data were expressed as number, percentage and mean + SD over the table. The evaluation was done by unpaired ‘t’test and Chi square (x2) test. The result was considered significant if p value was <0.05. Tables were used to show the results and bar diagram were performed as necessary

Data Analysis. Data was analyzed using SPSS version 21. Chi square test was used to test the *p* value.

Null Hypothesis. Antibiotics do not significantly reduce postoperative complications in young healthy patients following simple tooth extraction.

III. RESULTS

Out of the initial sample of 400 (200 in each group), 328 patients turned up for follow-up visit, out of which 141 (42.9%) were males and 187 (57.1%) were females. Antibiotic group comprised 152 patients (70 males and 82 females) and nonantibiotic group included 176 patients (79 males and 97 females).(Figure 1). Out of the total sample, 179 were maxillary teeth and 149 mandibular teeth (Table 1).

The mean age of the patients was 34.35 years±9.16. The most common reason for extraction was grossly carious teeth 32%, followed by periodontitis 27.7% and root pieces 11.5% (Figure 2,3).

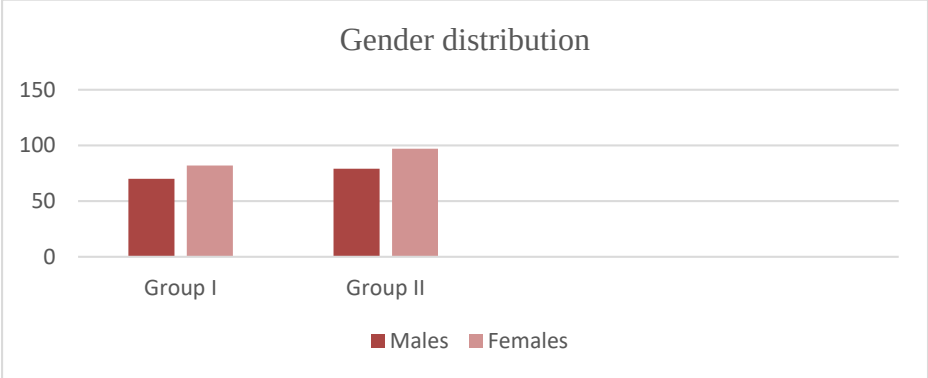

Figure 1. Gender distribution (diagram)

Table 1. Extracted teeth

Tooth extracted	11	12	13	14	15	16	17	18	21	22	23	24	25	26	27	28
Gp I	1	0	1	4	3	14	6	4	0	0	2	2	3	17	8	9
Gp II	1	1	1	4	4	26	9	8	0	2	2	3	9	15	11	9

Tooth extracted	31	32	33	34	35	36	37	38	41	42	43	44	45	46	47	48
Gp I	0	0	2	2	9	10	8	10	1	2	1	5	7	10	7	4
Gp II	1	2	2	3	8	9	8	5	0	2	1	2	3	16	6	3

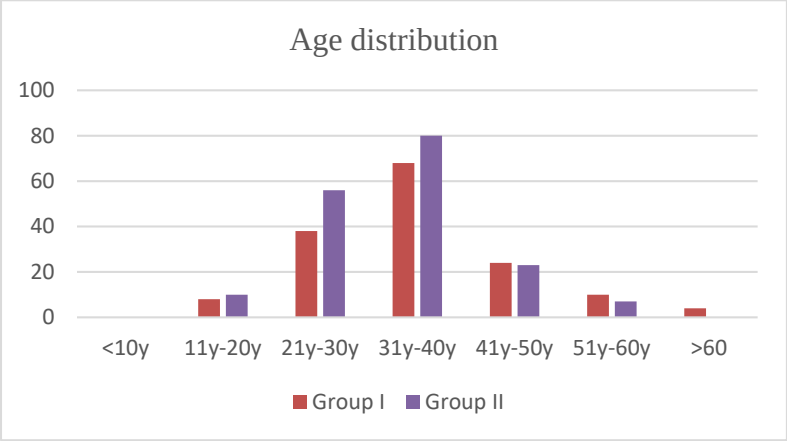

Figure 2. Age distribution(diagram

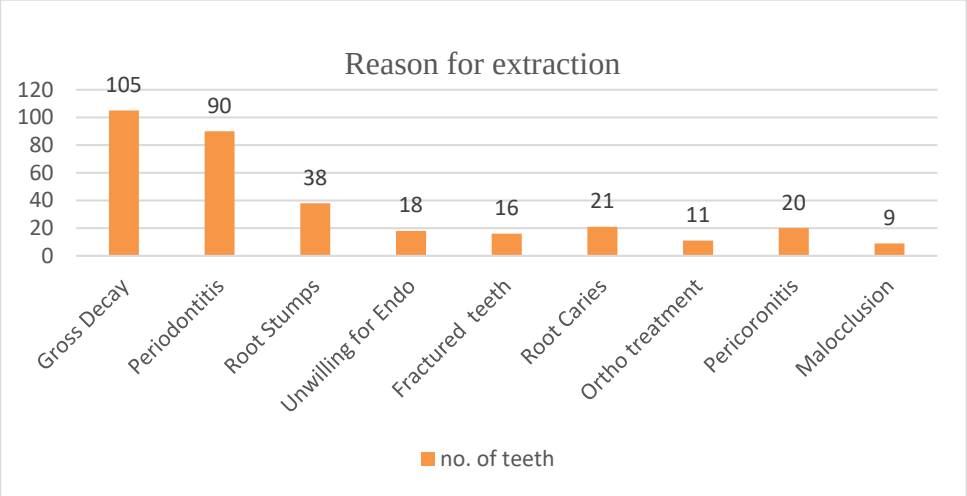

Figure 3. Reason for Extraction

The mean time taken for extraction was 8.52 minutes ± 3.46. Out of the total sample, 294 (89.6%) presented with no postoperative complications and 34 (10.4%) had postoperative complications, which included dry socket (alveolar osteitis) in 29 (8.8%) patients, 16 (4.8%) in the antibiotic group and 13 (3.9%) in the nonantibiotic group. 4 patients (1.2%) reported with infection of the extraction socket in nonantibiotic group, whereas 1 (0.3%) case of infection was found in the antibiotic group. Out of the 29 cases of dry socket, interestingly, 18 (62%) cases belonged to females, whereas 11(38%) was found in males. Although there was no relationship between antibiotic use and dry socket (Table 2), the overall female predisposition was also found statistically insignificant ($p = 0.43$). Of the patients presenting with dry socket, 24 patients had preoperative pain (12.5% of total cases with preoperative pain).). Out of the 29 patients who presented with postoperative dry socket, 24 (82.7%) were patients with dry socket who reported preoperative pain (12.5% of all cases with preoperative pain). Five cases of dry socket occurred in patients who reported no preoperative pain (4.5% of all cases who presented without any preoperative pain). However, this relationship was found to be statistically insignificant ($p = 0.06$) (Table 3).

Of the total sample, 23 (7%) patients showed adverse effect to the drugs prescribed. Diarrhea was reported in 7 (2.1%) patients, abdominal discomfort in 11 (3.3%) patients, and vomiting in 5 (1.5%) patients. About 86% (20) of patients who presented with adverse effects belonged to the antibiotic group. Only 3 patients from the nonantibiotic group reported adverse effects (2 vomiting and 1 abdominal discomfort) (Table 4). The relationship between adverse effects and antibiotics was proved to be statistically significant ($p = 0.0001$).

Table 2. Distribution of dry socket amongst male and females in both the groups

Male	Dry socket	X^2 0.23 *p value* = 0.62
Group I	6 (8.6%)	
Group II	5 (6.3%)	
Female		X^2 0.62 *p value* = 0.42
Group I	10 (12.2%)	
GroupII	8 (8.2%)	

Table 3. Association of preop. pain with dry socket

Preop pain	Dry socket yes	Dry socket No	X^2 3.45 *p value* = 0.06
Yes(216)	24 (11.1%)	192	
No (112)	5 (4.46%)	107	

Table 4. Drug Adverse effects

Adverse effects	Group I	Group II	X^2 0.605 *p value* = 0.0001
None	132	173	
Diarrhoea	7	-	
Abdominal discomfort	10	1	
Vomitting	3	2	

Pain scale indicated gradual increase in pain in the first 24 hours and a gradual decline over the next 5 days.

The overall trend showed the decrease in preoperative pain after the first hour followed by a slight increase after 6 hours and then a gradual decline over the next 5 days. This trend was equally represented in both groups although to varying degrees. (Table 5). The mean pain score between assessment stages (6 hrs, 12 hrs, 24 hrs, 48 hrs, and 72 hrs) shows a greater drop in the antibiotic group over 72 hours (p = 0.9 NS). Out of the total sample, 328 (152 in the antibiotic and 176 in the nonantibiotic group) patients presented with a complaint of preoperative pain ranging from very mild to very severe pain. Out of 328 patients, 29 (12 in the antibiotic and 17 in the nonantibiotic group) patients reported postoperative pain ranging from very mild to very severe even after 6 days. The average preoperative pain was 1.82 ± 1.73 in the antibiotic group and 2.07± 1.68 in the nonantibiotic group. Only 4 patients reported swelling after 6 days of extraction (2 each in both the groups).

Table 5. Mean distribution of pre-op and post-op. pain

Study group	Assessment stages	Mean	S.D	n
Group I (with antibiotics)	Preop	1.82	1.73	152
	6 hrs	1.56	0.83	152
	12 hrs	2.03	0.81	152
	24 hrs	1.25	0.78	152
	48hrs	1.21	1.8	152
	72 hrs	0.66	1.24	152
Group II (without antibiotics)	Preop	2.07	1.68	176
	6 hrs	1.42	0.52	176
	12 hrs	1.69	0.79	176
	24 hrs	1.31	0.88	176
	48 hrs	1.14	1.46	176
	72 hrs	0.76	1.22	176

IV. Discussion

The results of the present study indicate no significant role of antibiotics in simple extractions in terms of improving postoperative quality of life. The ideal agent to be used after tooth extraction should alleviate pain, reduce swelling and trismus to a minimum, promote healing and have no unwanted effects. Since such an agent does not exist, analgesics are the obvious choice for relief of pain, an analgesic with additional anti-inflammatory properties should be used wherever indicated[6].

The prophylactic use of antibiotics refers to the administration of these agents preoperatively to prevent a postoperative infection. Unless a significant risk of postoperative infection is present, generally, antibiotics should not be required before the removal of erupted carious or periodontally involved teeth. Although extraction sockets are considered contaminated wounds, the organisms involved are part of the normal oral flora, and therefore are not a usual source of postextraction infection. However, the decision of prophylactic antibiotics prescription in noninfected cases should also be based on whether patients have any significant medical risk factors that could adversely affect their humoral and cellular defense mechanisms, and whether any systemic risks are associated with the bacteremia that accompanies tooth extraction[7].

The data and literature to support prophylactic administration of oral antibiotics are inconsistent and have

demonstrated that neither preoperative nor postoperative prophylactic administration of antibiotics have shown any statistically significant benefit with regard to surgical site infection or alveolar osteitis over patients who did not receive antibiotic prophylaxis[1]. Pain experienced from pulpitis, periodontitis, alveolar osteitis, or peri-implantitis is not an indication for antibiotics. The antibiotics may serve to decrease local inflammation caused by surface biofilm bacteria and, therefore, reduce the patient's symptoms. These patients require mechanical or surgical intervention in the form of caries control, extractions, root canal therapy, scaling, and root planing, for example, rather than systemic antibiotics. However, patients presenting with cellulitis or abscess involving fascial planes may benefit from systemic antibiotics, where they serve as an adjunctive measure to surgical or mechanical removal of the infective source to prevent the hematogenous or local spread of the infective bacteria[1].

The results of the present study do not significantly justify the use of antibiotics following extractions. This was proved by the fact that there were only 5 cases(1.5%) of infection amongst the entire sample. These findings are similar to numerous other studies such as those by Agrawal et al[6], Yousuf et al[8] and van Eeden and B¨utow[9]. Conversely, a study done by Arteagoitia et al[10] reported a significant rise in the rate of infection related complications in individuals who were not prescribed antibiotics (up to 12.9%).

However, the aforementioned study was performed exclusively on impacted molars and therefore may have limited bearing on the present study. There were some postoperative complications in the present study too. A few patients presented with dry socket and postoperative pain even upon evaluation on the 6th day (see Table 5). The number of diagnosed dry socket cases was nearly similarly distributed in both groups. Dry socket is a phenomenon which relates to lack of clot retention/formation within the socket and is not considered an infectious process. These findings correlate with other studies conducted by Arteagoitia et al[10] and L´opez-Cedr´un et al[11] which noted no difference in prevalence of dry socket when postoperative antibiotics were given. However, it should be noted that in a study conducted by van Eeden and B¨utow[9], there were no cases of dry socket in individuals who were given antibiotics, whereas 15.8% of those who were not given antibiotics presented with dry socket.

Although all drugs are known to have adverse effects, unsurprisingly, patients belonging to antibiotics group reported more adverse effects when compared with their counterparts in the nonantibiotic group (see Table 4). Diarrhea, abdominal pain, and vomiting were the predominant gastrointestinal tract related effects. Although these cases presented in only a small minority of patients who consumed antibiotics, they still question the rationale behind antibiotic use unnecessarily without producing any tangible benefits. In fact this increases the physical as well as financial burden on the patient. This is especially a problem in developing countries where financial constraints make it difficult for patients to afford an antibiotic regimen in addition to treatment. Adverse effects of antibiotics can result in reduced quality of life and can significantly disrupt their daily work and probable source of livelihood. On a community level the antibiotic overuse has many consequences such as promoting the development of resistant organisms and unfavorable drug interactions[8]. Dental surgeons must take it as an ethical responsibility and play a pivotal role in preventing the propagation of such microbes by limiting the use of antibiotics and being selective in their prescription.

The antibiotic group showed a better pain profile than the nonantibiotic group, showing a steeper decline in pain over 72 hrs. (see Table 4). However, it should be noted that reduction in pain profile was not statistically significant (p = 0.99) in the present study and therefore does not justify the use of antibiotics. Studies conducted by van Eeden and B¨utow[9] and Agrawal et al[10], also reported no significant relationship between the use of antibiotics and postoperative pain. As studies have proved that this is unacceptable and a disservice to not only the patient but also the community at large, the practice of prescribing antibiotics routinely as a preventive measure to avoid postoperative complications, like pain and infection, must be discarded. The use of a stronger analgesic instead is a much better option after simple extractions to reduce pain in lieu of antibiotics[8].

V. Conclusion

Although circumstances exist when systemic antibiotics are indicated, proactive local measures are usually sufficient in treating bacterial infections of the oral cavity before antibiotics are truly indicated. Strict adherence to universal precautions and sterilization protocols wherever applicable may help prevent disease transmission as well. As dentists, we can do little to limit the use of antibiotics in other arenas like agriculture or regulate dumping of antibiotic manufacturing by-products into the environment. But we can strive to practice responsible, evidence-based medicine and dentistry. Prudent use of antibiotics plays an important role in minimising the impact of antimicrobial resistance on public health.

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