

THE INFLUENCE OF ANTIBIOTICS ADMINISTRATION ON INFECTION SUBSEQUENT TO DENTAL EXTRACTION

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ABSTRACT

Aims: The purpose of the current research is to estimate the effectiveness of antibiotic administration on socket healing and postoperative pain following dental extraction.

Materials and Methods: The research included 40 healthy patients between 20-35 years with an asymptomatic tooth at the time of extraction. Patients were randomly divided into four groups, three groups with antibiotics group [group 1: Augmentin; group 2: Azithromycin; group 3: Cefuroxime, and one group without antibiotics (control group)]. Patients were assessed on the fifth postoperative day to measure the socket healing and postoperative pain after extraction.

Results: There were statistically significant differences in socket healing and postoperative pain between the three antibiotic groups and Control groups on the fifth postoperative day. Augmentin and Azithromycin have a better effect on socket healing and postoperative pain control than cefuroxime.

Conclusions: The results of this study showed that antibiotic administration after the extraction of teeth reduces pain and accelerates socket healing.

KEYWORDS: Antibiotics, Socket Healing, Postoperative Pain, Dental Extraction, Healing Efficacy.

INTRODUCTION

Exodontia or tooth extraction is the most common procedure in oral surgical practice⁽¹⁻⁵⁾. In an ideal situation, it entails the painless removal of the whole tooth, or its roots from its socket, with minimal trauma to the surrounding soft tissues^(2, 4-8).

It is done as the last resort of treatment for painful non-restorable and infected teeth. Extraction of sound teeth (most commonly the premolars) may be part of the orthodontic treatment plan ⁽⁸⁻¹⁰⁾. The main reasons for extraction of permanent teeth are still carries and periodontal disease, in variable proportions according to the age of patients, country, and year of publication. Wisdom teeth failing to erupt or erupt only partially represent a distinct category of dental elements named impacted (third molar) teeth. Impacted wisdom teeth are extracted either because of local inflammatory problems, or to avoid probable future complications ⁽⁹⁻¹⁴⁾.

After tooth extraction, the alveolar bone heals without complications, however, associated with physiological and iatrogenic mechanisms, they show partial loss of alveolar bone as a natural, inevitable consequence, by means of trauma to the surrounding tissues. Since only one bony part will be remodeled, considering the impossibility of performing a completely atraumatic extraction ⁽¹²⁾.

The main objective for a successful surgery is to minimize, as much as possible, patient discomfort in the postoperative period after tooth extraction. Symptoms such as pain, swelling, trismus, fever, and dry socket are complications that are unpleasant for patients and could generate difficulty in chewing, speaking, performing oral hygiene, and alteration of other activities of daily living, resulting in days off from work or study ⁽¹⁰⁾.

All these complications depend on the inflammatory response, but they can be due to subsequent infection, for example, if surgical trauma is in a contaminated area (where severe caries or periodontitis is present), non-sterilized tools are used or where more complex and aggressive procedures are performed (e.g., ostectomy) ⁽¹⁵⁻²²⁾.

MATERIALS AND METHODS

STUDY DESIGN

This study was carried out at the Faculty of Dentistry, University of Tikrit in the Oral and Maxillofacial Surgery Department. After obtaining approval from the scientific committee, the study run from 10/10/2022 TO.... 9/2/2023

A case sheet specially designed for this study was filled out for each patient.

Forty medically healthy patients were randomly assigned, their ages ranged from 20 to 35 years and included males only ⁽¹⁶⁾.

The diagnosis of the tooth was based on clinical examination and standard intraoral periapical radiographs ⁽¹⁸⁾.

It was hypothesized that antibiotic administration has significant effects on infection following teeth extraction ⁽²⁰⁾.

INCLUSION CRITERIA INCLUDED

1. Free of inflammation and infection of tissue at the time of the surgical procedure. ⁽¹²⁻²¹⁾
2. Medically fit, not allergic, not taking any medication that could interfere with the study drugs ⁽¹⁹⁾.

EXCLUSION CRITERIA INCLUDED

1. History of compromised medical health, history of allergic reactions, or hypersensitivity to the medications used in the operative work ⁽²⁷⁾.
2. Patients receiving chemotherapy or radiation therapy ⁽²⁴⁾.
3. Patients needing total extraction or severe periodontitis, and patients who had any other oral pathology ⁽²⁵⁻²⁹⁾.
4. Patients' rejection of being involved in the research or those who could not commit to follow-up visits or those who used other drugs during the research period.

The patients were arbitrarily allocated to four treatment groups:

Group I: Included ten patients allocated to receive 625mg of combined amoxicillin and clavulanic acid (Augmentin) [klavox®(dar al dawa)] tablet three times daily for 5 postoperative days ⁽³¹⁾.



Figure 2.1 (Augmentin drug (klavox).)

Group II: Included ten patients allocated to receive 500mg of azithromycin [Zithromax ® (Pfizer)] capsule one time daily for five postoperative days ⁽³²⁾.



Figure 2.2 (Azithromycin drug (zithromax).)

Group III: Included ten patients allocated to receive 500mg of cefuroxime [zamor™ (acino)] capsule one times daily for five postoperative days ⁽³³⁾.



Figure 2.3 (cefuroxime drug (zamor).)

Group IV: Included ten patients allocated without any treatment.

- ❖ All patients were examined first with a dental mirror and dental explorer.
- ❖ Before the extraction procedure, all patients were instructed to use 0.12% chlorhexidine mouthwash.
- ❖ Indicated teeth were extracted under local anesthesia using 1.8ml of 2% lidocaine with 1:80,000 adrenaline.
- ❖ The removal of the teeth was performed following the standard procedure with as little trauma as possible to the surrounding soft tissues including utilizing dental forceps and elevators.
- ❖ Following the extraction, the socket was packed with gauze and the patient was asked to bite hard on it, to apply pressure to the socket wound.
- ❖ All patients were given the same post extraction instructions, both verbally and in written form, as follows ⁽³⁴⁾:

- (1) Do not rinse vigorously, suck on straws, for 24 h.
- (2) Do not smoke or drink alcohol for 72 h.
- (3) Commence warm saline mouthwash/bath after 24 h, six times daily for 1 week.
- (4) Take the prescribed antibiotics and analgesics in the right dosage at the right time.

- ❖ All patients have been prescribed 500 mg paracetamol 3 times on the first day after the procedure.
- ❖ All patients were reviewed after five days postoperatively for the assessment of socket wounds and compliance with both the postoperative instructions and the use of medications ⁽³⁵⁾.
- ❖ Clinical evaluation of the extraction sockets was done based on the following criteria ⁽³⁴⁾:

- (1) **Normal healing alveolus:** a healing alveolus with decreasing pain or without pain, with evidence of gradual or complete socket closure.
- (2) **Dry socket:** persistent or increased postoperative pain in and around the extraction site, accompanied by a partially or disintegrated blood clot or an empty socket, with or without halitosis; the diagnosis is confirmed when an extremely sensitive bare bone is encountered when passing a small curette into the extraction wound.
- (3) **Acutely inflamed socket:** painful socket with inflamed tissue, but without pus or systemic fever.
- (4) **Acutely infected socket:** painful socket with suppuration, erythema, and edema, with or without systemic fever.

- ❖ Postoperative pain was assessed using a 4-point VAS ⁽³¹⁾:

0 = Presence of no pain.

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

2 = Presence of moderate pain (pain reported in response to questioning and 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).



Figure 2.4 (upper right second premolar indicated for extraction.)



Figure 2.5 (socket of upper right second premolar immediately after atraumatic extraction.)



Figure 2.6 (socket healing after 5 days for patient receiving Augmentin drug.)



Figure 2.7 (lower right first molar indicated for extraction.)



Figure 2.8 (socket for lower right first molar immediately after atraumatic extraction.)



Figure 2.9 (socket healing after 5 days for patient receiving cefuroxime drug.)

RESULTS

The results of this study were analyzed by using SPSS (statistical package for social science) software, IBM Version 26.

RESULTS OF CLINICAL EVALUATION OF THE EXTRACTION SOCKETS

Table 1 showed that variable of socket healing after 5 days with three groups of antibiotics and one group without antibiotics.

Table 1 (socket healing after 5 days.)

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Augmentin	10	1.1000	.31623	.10000	.8738	1.3262	1.00	2.00
Azithromycin	10	1.2000	.42164	.13333	.8984	1.5016	1.00	2.00

cefuroxi me	10	1.800 0	.91894	.29059	1.1426	2.4574	1.00	3.00
Control	10	2.300 0	.82327	.26034	1.7111	2.8889	1.00	4.00
Total	40	1.600 0	.81019	.12810	1.3409	1.8591	1.00	4.00

According to the normality test, the variables are not normally distributed, so we use Kruskal-Walli's test. see table 2

Table 2 (Kruskal-Walli's test.)

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of VAR00001 is the same across categories of VAR00002.	Independent-Samples Kruskal-Wallis Test	.001	Reject the null hypothesis.

Table 3 showed there are not significantly differences between Augmentin and azithromycin groups but there are highly significant differences between Augmentin or azithromycin and control groups after 5 days of extraction

And there are significant differences between Augmentin and cefuroxime groups after 5 days of extraction

Table 3 (Post hoc test.)

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig. ^a
Augmentin-Azithromycin	-1.700	4.640	-.366	.714	1.000
Augmentin-cefuroxime	-9.200	4.640	-1.983	.047	.284
Augmentin-Control	-16.300	4.640	-3.513	.000	.003
Azithromycin-cefuroxime	-7.500	4.640	-1.616	.106	.636
Azithromycin-Control	-14.600	4.640	-3.147	.002	.010
cefuroxime-Control	-7.100	4.640	-1.530	.126	.756

RESULTS OF POSTOPERATIVE PAIN

Table 4 showed that variable of postoperative pain after 5 days with three groups of antibiotics and one group without antibiotics.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Augmentin	10	.5000	.52705	.16667	.1230	.8770	.00	1.00
Azithromycin	10	.8000	.78881	.24944	.2357	1.3643	.00	2.00
cefuroxime	10	1.2000	.42164	.13333	.8984	1.5016	1.00	2.00
control	10	2.0000	.66667	.21082	1.5231	2.4769	1.00	3.00
Total	40	1.1250	.82236	.13003	.8620	1.3880	.00	3.00

According to the normality test, the variables are not normally distributed, so we use the Kruskal-Wallis test. see table 5

Table 5 (Kruskal-Wallis test.)

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of VAR00001 is the same across categories of VAR00002.	Independent-Samples Kruskal-Wallis Test	.000	Reject the null hypothesis.

Table 6 showed there are not significantly differences between Augmentin and azithromycin groups but there are highly significant differences between Augmentin or azithromycin and control groups after 5 days of extraction

And there are significant differences between Augmentin and cefuroxime groups after 5 days of extraction

Table 6 (Post hoc test.)

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig. ^a
Augmentin-Azithromycin	-4.300	4.866	-.884	.377	1.000
Augmentin-cefuroxime	-9.900	4.866	-2.035	.042	.251
Augmentin-Control	-19.800	4.866	-4.069	.000	.000
Azithromycin-cefuroxime	-5.600	4.866	-1.151	.250	1.000

Azithromycin-Control	-15.500	4.866	-3.185	.001	.009
cefuroxime-Control	-9.900	4.866	-2.035	.042	.251

n the significance level is .05.

DISCUSSION

This study's purpose is to compare the effectiveness of various antibiotics on healing and post-operative pain experienced after teeth extraction five days after interviewing participants.

There were many obstacles we had to overcome in this study, including patients' noncompliance with prescribed medication, their tendency to skip appointments, and the inconsistency of the drugs they were prescribed. In addition to picking the participant that is disease- and complication-free and fully conforms to all requirements. Patients' lack of dedication on the follow-up date also posed a problem, as it meant many instances were missed. It was also difficult to make sure the patient kept taking their medicine regularly in accordance with the research's recommended protocol.

During the research period, we had to exclude any participants who did not meet the research requirements, which required more time and effort.

When compared to all other categories, Augmentin is superior.

Authors prefer amoxicillin-clavulanate, due to the growing number of bacterial resistances, as well as its broad spectrum, pharmacokinetic profile, tolerance, and dosing characteristics ⁽³⁶⁾.

This drug's success in prescriptions can be attributed to its end outcome The first group proved most effective in alleviating post-surgery discomfort and promoting healing by suppressing the infection caused by gram-positive and gram-negative bacteria, including Enterococcus species, Listeria monocytogenes, Streptococcus species, Haemophilus influenzae, Corynebacterium diphtheria, E. coli, Klebsiella pneumonia, Salmonella spp., Shigella spp. Furthermore, the spectrum is increased to include all beta-lactamase-producing strains of the previously mentioned organisms and broadening the coverage to include methicillin-sensitive Staphylococcus aureus (MSSA), Neisseria species, Pasteurella multocida, and Capnocytophaga canimorsus, among others ⁽²¹⁾.

Even though the second group fared better than the third, which had less impact on healing or pain, azithromycin is effective against anaerobes and gram-negative bacilli. After an oral dosage of 500 mg o.d for 3 days, significant levels of azithromycin can be detected in most tissues for 7-10 days. It has been proposed that azithromycin penetrates fibroblasts and phagocytes in concentrations 100-200 times greater than that of the extracellular compartment. The azithromycin is actively transported to sites of inflammation by phagocytes, then directly released into the sites of inflammation as phagocytes rupture during phagocytosis ⁽³⁷⁾.

cefuroxime (Second- generation cephalosporins) has less activity against Gram-positive cocci (Streptococcus, Staphylococcus and related geni) which are found in the oral cavity.

While subjects in the fourth group, some participants experienced inflammation and pain following extraction.

The results of our study agree with the result of the study by López-Cedrún et al⁽³⁸⁾. While our result is against the results by Basílio Almeida Milani et al. Oral Maxillofacial Surg.⁽³⁹⁾.

The drawback to the evident benefits of antibiotic treatment is represented by the undesired effects of their use. On one hand, there are side effects with repercussions for the patient, such as gastric, hematological, neurological, dermatological, allergy, and other disorders⁽⁴⁰⁾.

CONCLUSIONS

Antibiotic administration after tooth extraction reduces pain and accelerates socket healing by preventing infection and promoting faster recovery. augmentin and azithromycin demonstrated the most significant effects on pain reduction and socket healing, effectively controlling infection and enhancing recovery. in contrast, cefuroxime showed the least significant impact, with less pronounced effects on healing and pain reduction. in the control group, some participants experienced inflammation and pain, emphasizing the importance of antibiotics in managing these symptoms. based on the results, augmentin was the most effective in reducing pain and improving healing, making it the preferred choice for post-extraction care to ensure optimal recovery.

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