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A Comparison of a Combination of Pre-Emptive Amoxicillin and Clavulanic Acid and Combination of Post Operative Amoxicillin+ Clavulanic Acid for Prevention of Post Operative Complications in Surgical Dental Extractions: A Prospective Study

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KEYWORDS

Surgical Extractions, Amoxicillin, Clavulanic Acid, Pain, Complications

ABSTRACT:

Background: Oral antibiotics are crucial after surgical extraction in order to accelerate the healing process. There is still a lack of substantial evidence supporting the use of preoperative oral antibiotics for reducing complications following the surgical removal of teeth.

Materials and methods: The participants were divided into 2 groups based on the analgesic used preemptively or postoperatively: Group 1- pre operative amoxicillin 500 mg+clavulanic acid 125mg and post operative amoxicillin 500 mg+clavulanic acid 125mg (n=20) and Group 2: post operative amoxicillin 500 mg+clavulanic acid 125mg (n=20). Post operative pain was measured using the Visual Analog Scale (100mm) from post operative day 1 to post operative day 5.

Results: Post operative pain from POD 1 to POD 5 significantly reduced in the group taking pre operative and post operative amoxicillin 500 mg+clavulanic acid 125mg. The mean VAS score reduction was statistically significant. (p=0.02) 10% (2 patients) and 15 % (3 patients) in the pre operative + post operative amoxiclav group developed dry socket and infection respectively. On the other hand in the post operative Amoxiclav group, 15% (3 patients) developed dry socket and 20% (4 patients) developed infection. Clinically the complications were more in the only post operative amoxiclav group but it was not statistically significant.

Conclusion: Clinically, this study showed that the administration of a single preoperative dose of amoxicillin 500mg+ clavulanic acid 125mg along with a full postoperative dose was more effective than conventional treatment with only post operative coverage for reducing the incidence of complications post surgical extractions. However these results were not statistically significant.

1. Introduction

Oral antibiotics are crucial after surgical extraction in order to accelerate the healing process [1,2]. Formation of necrotic tissue at the extraction site is an important cause of dry socket or infection post surgical extraction [3,4,5,6]. A bacterial infection, a mechanical injury, bone hyperthermia, lack of vascularity or any combination of these may cause necrosis. Adjacent tissues are invariably injured during surgical extraction since the procedure entails soft tissue manipulation and guttering of the buccal side using high-speed drills. [1,2,3,4,5,6]

These necrotic tissues have inadequate nutritional supply, which hinders formation of normal, healthy granulation tissue and makes them a prime site for bacteria proliferation and damage during surgical extraction [3,5,7,8]. Moreover, the majority of surgical extractions are performed for severely decayed teeth with pre existing abscesses and apical diseases. As long as there are odontogenic infections, elevation of the flaps and removal of the bone, there is a possibility of dry socket and involvement of facial spaces.

In order to determine the effect of preoperative amoxicillin on surgical site infections in a Japanese population having lower third molar extractions, Yoshida et al. [2] conducted a study. According to the results, giving amoxicillin one hour prior to surgery and for three

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days afterward might help avoid infections at the site of surgery(SSI).

Few studies have indicated use of pre operative antibiotics but there is still a lack of evidence supporting the use of preoperative oral antibiotics for reducing the occurrence of dry socket and infection following the surgical removal of teeth.

The aim of this study was to compare the efficacy of a preoperative single dose of amoxiclav (amoxicillin 500 mg + clavulanic acid 125 mg) plus postoperative dose with only post operative amoxiclav coverage in prevention of dry socket and infection in patients undergoing surgical extractions.

2. Materials and methods

The participants for the study were recruited from the outpatients of the Department of Oral and Maxillofacial Surgery, Saveetha Dental College and Hospital, Chennai, Tamil Nadu, India in patients presenting with a requirement for surgical removal of the impacted mandibular molar tooth. The Institutional Human Ethics committee had given approval for conducting the study (IHEC/SDC/OMFS-2302/24/116) and written informed consent was obtained from the participants for the same.

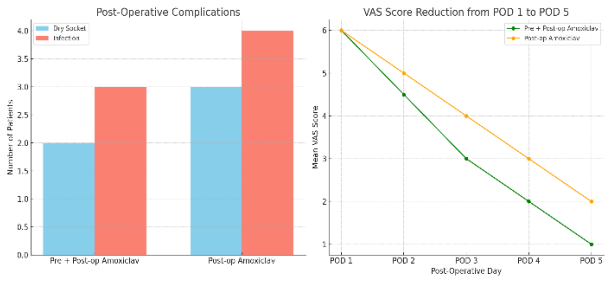
Inclusion criteria included those whose age was more than 18 years. Those with Symptomatic impacted mandibular third molar (mesioangular, position A, class I) willing for extraction, those willing to Comply with pre and post operative antibiotic protocol and those willing to give informed consent.

Exclusion criteria included those patients who were sensitive/allergic to amoxiclav, patients undergoing multiple extractions, those not willing for the extraction, those who were already on other antibiotics and those not willing to adhere to the drug protocol.

Each of these patients underwent surgical removal of the impacted mandibular third molar and was randomly divided into two groups. The group allocation was done based on the analgesic used preemptively or postoperatively: Group 1: pre operative amoxiclav +post operative amoxiclav (n=20) and Group 2: post operative amoxiclav (n=20). A single operator performed all the surgical procedures. The patients were allocated into two groups based on sealed opaque envelopes prepared by the investigator and both the operator and the participant were unaware of the study grouping (double blinding). The mandibular anaesthesia was induced with 2% lignocaine hydrochloride with 1:80,000 epinephrine using inferior alveolar nerve block. Full thickness mucoperiosteal flap was elevated and the tooth was elevated and removed. Closure was done using 3-0 silk. 20 patients were administered amoxiclav twice a day for 5 days post surgical extraction while the other 20 patients were administered amoxiclav one hour pre operatively+ post operatively twice a day for 5 days. Standard post operative instructions and medications were given to both the groups. Post operative pain was measured using the Visual Analog Scale (100mm) from post operative day 1 to post operative day 5 and patients were assessed for signs of infection or dry socket.

3. Results

Out of the 20 patients in each group, 10% (2 patients) and 15 % (3 patients) in the pre operative + post operative amoxiclav group developed dry socket and infection respectively. On the other hand in the post operative Amoxiclav group, 15% (3) developed dry socket and 20% (4) developed infection. Clinically the complications were more in the only post operative amoxiclav group but it was not statistically significant. Post operative pain from POD 1 to POD 5 significantly reduced in the group taking pre operative and post operative amoxiclav. The mean VAS score reduction was statistically significant. (p=0.02)



4. Discussion

Amoxiclav is a synergistic combination of two agents: amoxicillin, a broad-spectrum beta-lactam antibiotic, and clavulanic acid, a beta-lactamase inhibitor. This combination enhances the overall efficacy of the antibiotic therapy by overcoming one of the main resistance mechanisms encountered in clinical practice—beta-lactamase enzyme production by bacteria. [12,13]

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Amoxicillin exerts its bactericidal action by binding to penicillin-binding proteins (PBPs) within the bacterial cell wall, ultimately inhibiting the final step of peptidoglycan synthesis [14]. This leads to cell wall weakening and bacterial lysis. Amoxicillin is structurally and functionally similar to ampicillin but demonstrates better gastrointestinal absorption and achieves higher and more consistent serum and tissue concentrations, making it more effective in systemic infections [5,11]. However, a significant limitation of amoxicillin, like other beta-lactams, is its susceptibility to degradation by beta-lactamase enzymes produced by resistant bacteria. These enzymes hydrolyse the beta-lactam ring, rendering the antibiotic ineffective, particularly against Staphylococcus aureus and various gram-negative anaerobes. [15]

Clavulanic acid, although structurally related to beta-lactam antibiotics, has minimal intrinsic antibacterial activity. Its primary role is to act as an irreversible inhibitor of beta-lactamase enzymes. By binding covalently to the active site of these enzymes, clavulanic acid prevents them from hydrolyzing the beta-lactam ring of amoxicillin. This protective effect allows amoxicillin to exert its antibacterial activity against otherwise resistant organisms [1,7,11,16].

The combination of these two agents—co-amoxiclav—broadens the antimicrobial spectrum of amoxicillin to include beta-lactamase–producing pathogens [2,9,10]. This is particularly important in the management of mixed infections or infections caused by organisms of uncertain resistance profiles. Co-amoxiclav is effective against many gram-positive and gram-negative aerobes and anaerobes, making it a versatile option in both community-acquired and hospital-acquired infections. It is particularly useful in treating respiratory tract infections, urinary tract infections, skin and soft tissue infections and oral infections. [11, 17]

In the context of oral surgery, co-amoxiclav is widely prescribed either prophylactically or therapeutically. Dental procedures such as tooth extractions, particularly in immunocompromised patients or those with a high risk of post-operative infection, often warrant antibiotic coverage [18]. The oral cavity harbors a diverse microbiota, including anaerobic and facultative anaerobic organisms that can cause localized or systemic infections if they gain access to deeper tissues or the bloodstream during procedures. Co-amoxiclav is effective against many of these oral pathogens, including Streptococcus species, Actinomyces, and beta-lactamase–producing strains of Prevotella and Fusobacterium, which are common in odontogenic infections. [12, 19]

Metronidazole is a nitroimidazole antibiotic with excellent activity against obligate anaerobic bacteria, which are commonly found in the oral cavity. It is particularly effective in managing infections caused by Prevotella, Fusobacterium, and Porphyromonas species [19]. Metronidazole is often used in combination with penicillins, especially when an anaerobic infection is suspected or confirmed. In patients allergic to penicillin, metronidazole may be used alone or alongside macrolides or clindamycin for broader coverage. However, it has limited activity against aerobic bacteria and should not be used as monotherapy unless anaerobes are clearly implicated.[20]

However, it is important to note that overuse or inappropriate use of co-amoxiclav can contribute to the development of antibiotic resistance and adverse effects such as gastrointestinal upset and antibiotic-associated diarrhea, including Clostridioides difficile infection. Therefore, its use should be guided by judivious institutional antibiotic policies and individual patient risk assessments.

5. Conclusion

Clinically, this study showed that the administration of a single preoperative dose of amoxiclav with a full postoperative dose of amoxiclav was more effective than conventional treatment with only amoxiclav post operatively for reducing the incidence of both dry socket and infection after surgical extractions. Co-amoxiclav offers broad-spectrum coverage and is especially beneficial in polymicrobial infections where beta-lactamase–producing organisms are suspected.

Additional information

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