ANTIBIOTIC PROPHYLAXIS IN THIRD MOLAR SURGERY

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A thesis submitted in fulfilment of the requirements for the Degree, Magister Scientiae Dentium, Department of Maxillo-Facial and Oral Surgery, Faculty of Dentistry, University of the Western Cape

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Antibiotic prophylaxis in third molar surgery

Key words

Antibiotic prophylaxis

Amoxicillin

Third molar surgery

Local anaesthesia

Analgesics

Pain

Swelling

Infection

Dry socket

Trismus

Temperature

SUMMARY

The use of prophylactic antibiotics in oral surgery is widespread and often inappropriate. Appropriate antimicrobial treatment greatly improves the prognosis of infectious disease. However, the indiscriminate use of antibiotics may increase the risks of drug resistant pathogens, side effects and cost of medical care

In the latest review article (Antibiotic prophylaxis for dentoalveolar surgery: is it indicated), Lawler (2005) summarizes that there are no randomized controlled clinical studies of antibiotic prophylaxis for dentoalveolar surgery, including third molar removal and dental implantation. Other less rigorous studies show conflicting and commonly equivocal results.

The use of prophylactic antibiotics to reduce postoperative complications in third molar surgery remains controversial. Some authors favour routine prophylaxis. Some suggest it to be indicated with the difficult cases only, while others report no benefit. However, any antibiotic when used prophylactically, will only provide adequate protection when effective levels are present at the time of bacterial contamination. The recommended standard antibiotic regimen for odontogenic infections is still penicillin. The antibiotics amoxicillin, ampicillin and Pen-V are equally effective in vitro against Alfa-haemolytic streptococci; however, amoxicillin is recommended, because it is better absorbed from the GI tract and provides higher and more sustained serum levels.

The purpose of this study is to evaluate the need for prophylactic antibiotic treatment in third molar surgery and to establish specific guidelines for antibiotic

prophylaxis in the department of Maxillo-Facial and Oral Surgery (MFOS) at Tygerberg Academic, Groote Schuur and Mitchells Plain Hospitals.

The study was designed as a prospective, randomized, double blind, placebo controlled clinical trial in which the patients were randomly assigned to two groups. The two groups were paired using radiographs and Pell and Gregory classification. The surgery was performed under local anaesthesia. The first group received a stat dose of antibiotics (Amoxicillin 1 gm, 1- hour before the start of operation). The second group received a 1 gm stat dose of antibiotics and then 500 mg 8 hourly orally for two days, which is the current empiric protocol used by the MFOS unit at Tygerberg. Each group functioned as its own control. Two wisdom teeth were removed under antibiotic cover and two removed without antibiotic cover. Neither patient nor surgeon knew which teeth were removed under antibiotic cover.

Pain, swelling, infection/ purulent discharge, inter-incisal mouth opening / trismus and temperature were recorded on the third, seventh and fourteenth day of surgery. We compared the complication rates of these two groups. Any side-effects (possible) related to antibiotics were also recorded.

The results of the study showed that the prophylactic antibiotics do not provide additional effects on postoperative infections. There is therefore no justification to use antibiotics routinely for third molar surgery. However, we need a safe and effective analgesic and anti-inflammatory combination after third molar surgery to prevent post-operative pain.

From the results of our study, we believe that single dose pre-operative prophylaxis is a scientifically based way to minimize the infection rate and costs in a hospital setting.

DECLARATION

I hereby declare that Antibiotic prophylaxis in third molar surgery, a prospective double blind placebo controlled clinical trial using split mouth technique, is my own work. It has not been submitted before for any degree or examination in any university. All the sources I have used or quoted have been indicated and acknowledged by complete references.

A Siddiqi

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AKNOWLEDGEMENTS

Finally, I wish to express my loving thanks to my wife Sobia and my son Mustafa for patience and support. Her encouragement has been valuable for my development as a researcher.

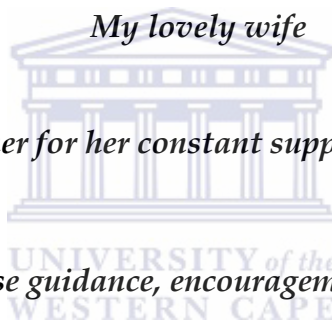Cape Town   Siddiqi

Dedicated

To

My lovely wife

To my mother for her constant support and sacrifice

To my supervisor whose guidance, encouragement, help and support made

this project possible

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CHAPTER -1

INTRODUCTION

Antibiotic prophylaxis is defined as the use of antibiotics to prevent infection. Infection occurs when there is a significant quantitative and qualitative bacterial insult.

Prevention of infection can be accomplished by achieving two goals.

1. Reducing the number of bacteria in the surgical wound.
2. Enhancing host defense so as to prevent the bacteria that inevitably enter the wound from causing clinically evident infection.

Burke (1961) established that the maximum effectiveness of prophylactic antibiotics occurs when the antibiotic is in the tissue when bacteria arrive (Burke et al, 1961).

Appropriate antimicrobial treatment greatly improves the prognosis of infectious disease. However, the indiscriminate use of antibiotics may increase the risks of drug resistant pathogens, side effects and cost of medical care. World wide many strains of staphylococcus aureus exhibit resistance to antimicrobial drugs, including vancomycin. Methicillin resistant staphylococcus aureus is one of the most frequent nosocomial pathogens (Zeitler et al, 1995). In central Africa, some strains of shigella are no longer sensitive to quinolone antibiotics. Therefore it has become problem to treat recent outbreaks and thousands have died.

Penicillin resistant Staphylococcus pneumoniae has passed resistant genes to the previously susceptible staphylococcus viridans species (ADA Council on scientific

affairs 2004). Antibiotic prophylaxis for surgical infections requires specific dosing schedules (perioperative surgical prophylaxis) to be successful.

<u>Peterson in 1990 established principles of antibiotic prophylaxis</u>

Principle I   The surgical procedure should have a significant risk of infection

Principle II   Select the correct antibiotic for the surgical procedure.

Principle III   The antibiotic level must be high.

Principle IV   Time the antibiotic administration correctly.

Principle V   Use the shortest effective antibiotic exposure.

Peterson (1990) also classified surgical procedures by expected degree of contamination, and the expected incidence of post-operative infections.

Peterson Classification (JOMS 1990:48)

Class I surgery, also known as clean surgery, occurs when no transaction of the respiratory, gastrointestinal, or urinary tracts occurs, and there is no break in surgical-aspect technique. It has an infection rate of approximately 2%, and it can be reduced to less than 1% by good surgical technique.

Class II surgery, clean contaminated surgery, exists when no significant bacterial contamination results. Trans-oral surgery is considered to be in this class. The expected infection rate in clean contaminated surgery is 10% to 15%, and it can be reduced to approximately 1% by a good surgical technique and prophylactic antibiotics.

In class III surgery (contaminated surgery) the infection rate is 20% to 30%, and by excellent technique and prophylactic antibiotics it can be reduced to 10%.

Class IV surgery (dirty) surgery exists when there is established clinical infection or a traumatic injury of more than 8 hours old. It has an infection rate of nearly 50% (Peterson 1990; Pallasch et al, 1989).

Third molar surgery (trans-oral) falls into the category of clean contaminated surgery. If the use of antibiotics for third molar surgery is to be recommended, Peterson's principle I must be proved.

However, there are sufficient reports on complications associated with antibiotic usage to raise the question of whether the possible risks of prophylaxis do not outweigh any minor benefits? When approximately 5% of patients receiving antibiotics have adverse reactions (Laskin, 2003; Stone et al, 1979), many of which are severe or life threatening, it seems appropriate to evaluate the potential value of prophylactic antibiotic in third molar surgery.

There are no randomized controlled clinical studies of antibiotic prophylaxis for dento-alveolar surgery, including third molar removal and dental implantation. Other less rigorous studies show conflicting and commonly equivocal results (Stuart et al, 2004).

The recommended standard antibiotic regimen for odontogenic infections is still penicillin. The antibiotics amoxicillin, ampicillin and Pen-V are equally effective in vitro against Alfa-hemolytic streptococci; however, amoxicillin is recommended because it is better absorbed from the GI tract, provides higher and more sustained serum levels (Lawler et al, 2005).

The aim of this study was to establish specific guidelines for prophylaxis in third molar surgery in the department of MFOS at Tygerberg Academic, Groote Schuur and Mitchells Plain hospitals.

CHAPTER 2

LITERATURE REVIEW

2.1. INTRODUCTION

2.1.1. Spread of dental Infection

The healthy body usually lives in balance with a number of resident normal flora. However, pathogens can invade and initiate an infectious process. Dental infections involving the teeth or associated tissues are caused by oral pathogens that are predominantly anaerobic and usually of more than one species. These infections can be of dental origin or from a non-odontogenic source. Those of dental origin usually originate from progressive dental caries or extensive periodontal disease. Pathogens can also be introduced deeper into the oral tissues by the trauma. Treatment entails removal of the source of infection, systemic antibiotics and drainage.

2.1.2. Antibiotic prophylaxis

Antibiotic prophylaxis is defined as the use of antibiotics to prevent infection. Infection occurs when there is a significant quantitative and qualitative bacterial insult (Peterson et al, 1990). Appropriate antimicrobial treatment greatly improves the prognosis of infectious disease. However, the indiscriminate use of antibiotics may increase the risks of drug resistant pathogens, side effects and increased costs of medical care.

2.1.3. Principles of antibiotic prophylaxis

Indications: Criteria for use:

1) The health benefits must outweigh the antibiotic risks

2) The cost-benefit ratio must be acceptable

3) The antibiotic must be in the blood/target tissue before surgery

4) An antibiotic loading dose should be used

5) The choice of the antibiotic should be made on the single most likely microorganism to cause an infection

6) The antibiotic should be continued only as long as the microbial contamination of or from the operative site continues (Burke et al, 1961; Stone et al, 1979)

Contraindications:

1) Prophylaxis is random in efficacy to be reliable

2) The bacteremia to be prevented is seldom a cause of disease

3) Prophylaxis is directed at any/all potential pathogens rather than the colonization of a single microbial pathogen (Burke et al, 1977; Polk et al, 1969)

Indications for surgical prophylaxis:

1) In clean-clean surgery where the risk of infection is remote, but its potential consequences are grave or in clean-contaminated surgery, where the likelihood of infections is great but seldom fatal

2) To prevent contamination of a sterile area

3) Where infection is unlikely but is associated with major morbidity

4) In surgical procedures with high infection rates

5) During implantation of prosthetic material to prevent bacterial endocarditis (Stone et al, 1984; Paluzzi et al, 1993)

Adverse effects:

1) Increased risk of antibiotic toxicity or allergy

2) Increased risk of super-infections

3) Selection of antibiotic-resistant microorganisms

4) Induction of resistance gene expression or transfer (New HC, 1979)

Based on these principles, the use of antibiotics to "prevent" postoperative complications after treatment is inappropriate, as the drug is not in the system before microbial contamination. This is another violation of the basic principles of prophylaxis. Often the drug is then continued for many days after the procedure, which allows for selection of resistant bacteria or resistance gene expression or transfer.

Orofacial infections after dental procedures are uncommon. The only possible indication for surgical antibiotic prophylaxis in the oral cavity is implant placement. No clinical studies have adequately documented the efficacy of peri-operative antibiotic prophylaxis in the prevention of orofacial infections.

2.2. INFECTIVE ENDOCARDITIS (IE)

Infective endocarditis (IE) is a microbial infection of the endocardial surfaces usually involving the cardiac valves. The condition is relatively uncommon with a prevalence of 11–50 cases per million population per year (Young, 1987).

Dental procedures, especially those that result in a bacteraemia, are frequently blamed for IE, hence the need for antibiotic prophylaxis to cover such procedures in patients at risk. This has been the clinical doctrine and teaching for the past 50 years. Recent evidence from the USA (Strom et al, 1998) and studies from the Netherlands (Van der Meer et al, 1992; 1996) have presented further

data which challenges the practice of prescribing antibiotics before dental procedures to prevent endocarditis. This information also needs to be considered in tandem with the increasing concern over the indiscriminate use of antibiotics.

2.2.1. British Society of Antimicrobial Chemotherapy (BSAC) guidelines for antibiotic prophylaxis (www.bes.com/library)

Conditions predisposing to risk of infective endocarditis

• History of infective endocarditis

• Ventricular septal defect

• Patent ductus arteriosus

• Coarctation of the aorta

• Prosthetic heart valves

• Rheumatic and other acquired valvular disease

• Surgical constructed systemic-pulmonary shunts

• Persistent heart murmur

• Atrial septal defect repaired with a patch

• Hypertrophic cardiomyopathy

• Marfan's syndrome

Patients not at risk from infective endocarditis

• After coronary by-pass surgery

• Six months after surgery for:

  • Ligated ductus arteriosus

  • Surgically closed atrial or ventricular septal defects (without Dacron [®] patch)

  • Isolated secundum atrial septal defect

Special risk patients

- Those with a previous history of infective endocarditis
- Those that require a general anaesthetic and have a prosthetic heart valve, are allergic to penicillin or who had had penicillin more than once in the previous month (Seymour et al, 2000)

2.2.2. ANTIBIOTIC REGIMENS (BSAC)

<u>Local or no anaesthesia</u>

No allergy to penicillin

Amoxycillin 3g orally 1 before operation

Allergic to penicillin

Clindamycin 600mg orally 1 hour before operation

<u>General anaesthesia</u>

No allergy to penicillin

Amoxycillin (3g) and probenecid (1g) orally 4 hours before procedure or amoxycillin (3g) orally 4 hours before and 3 g after surgery or amoxycillin (1g) intravenously at induction and 500mg orally 6 hours later

Allergic to penicillin

These patients are classified as special risk patients

Special risk patients

No allergy to penicillin

Intravenous amoxycillin 1g and intravenous gentamicin (120mg) before surgery or at induction, and amoxicillin (500mg) orally 6 hours later

Allergic to penicillin

Intravenous teicoplanin (400mg) and intravenous gentamicin (120mg) before procedure or at induction or clindamycin (300mg) given intravenously over 10 minutes in 50 ml before surgery or at induction and 150mg (oral or intravenous) 6 hours later or vancomycin (1g slow intravenous infusion over not less than 100 minutes), followed by gentamicin (120mg intravenous) before surgery or at induction.

Dosage for children:

Amoxycillin or clindamycin:	Children under 10 years, half the adult dose
	Children under 5 years, one-quarter of adult dose
Vancomycin:	Children under 10 years, 20 mg/kg
Gentamicin:	Children under 14 years, 6mg/kg (or 2mg/kg if with teicoplanin
	Children under 10 years, 2 mg/kg
Teicoplanin:	Children under 14, 6 mg/kg

Amoxycillin may be given twice in one month as it is unlikely that proliferation of clinically significant amoxycillin-resistant strains will occur after one 3 g dose of amoxycillin. A third dose of amoxycillin, however, should not be given until after an interval of one month. Two weeks should elapse between prophylactic doses of clindamycin (Ramsdale et al, 2005; Seymour et al, 2000 and 2002; Lesley et al, 1993).

2.2.3. AMERICAN HEART ASSOCIATION GUIDELINE FOR ANTIBIOTIC PROPHYLAXIS (JAMA, JUNE 11, 1997- VOL 227, NO. 22)

Cardiac conditions associated with endocarditis

High risk category

- Prosthetic heart valves, including bioprosthetic and homograft valves
- Previous bacterial endocarditis
- Complex cyanotic congenital heart disease (e.g. single ventricle states, transposition of the great arteries, tetralogy of Fallot.
- Surgically constructed systemic pulmonary shunts or conduits

Moderate risk category

- Most other congenital cardiac malformations
- Acquired valvular dysfunction (e.g. rheumatic heart disease)
- Hypertrophic cardiomyopathy
- Mitral valve prolapse with valvular regurgitation and/or thickened leaflets

Negligible-risk category (no greater risk than the general population)

- Isolated secundum atrial septal defect
- Surgical repair of atrial septal defect, ventricular septal defect, or patent ductus arteriosis (without residue beyond 6 months)
- Previous coronary artery by-pass graft surgery
- Mitral valve prolapse without valvular regurgitation
- Physiologic, functional or innocent heart murmurs
- Previous Kawasaki disease without valvular dysfunction
- Previous rheumatic fever without valvular dysfunction
- Cardiac pacemakers and implanted defibrillators

2.2.4. ANTIBIOTIC REGIMENS (AHA)

Standard general prophylaxis

Adults: Amoxycillin 2g

Children: Amoxycillin 50mg/kg 1 hour before procedure

Unable to take oral medications

Adults: Ampicillin 2g iv or im

Children: Ampicillin 50mg/kg im or iv within 30 minutes before procedure

Allergic to penicillin

Adults: Clindamycin 600mg

Children: Clindamycin 20mg/kg 1 hour before procedure

Or

Adults: Azithromycin or Clarithromycin 500mg

Children:

Azithromycin or Clarithromycin 15mg/kg orally 1 hour before surgical procedures for which antibiotic prophylaxis is recommended

Allergic to penicillin before procedure and unable to take oral medication

Adults: Clindamycin 600 mg iv or im

Children: Clindamycin 20 mg/kg iv within 30 minute

(Ramsdale et al, 2005; Seymour et al, 2000 and 2002)

Dental Procedures for Which Antibiotic Prophylaxis Is Recommended To Prevent Infective Endocarditis (AHA Recommendations)

- Dental extractions
- Periodontal procedures, including surgery, scaling, root planning, probing periodontal   pockets and recall maintenance
- Dental implant placement and re-implantation of avulsed teeth
- Endodontic (root canal) instrumentation or surgery beyond the apex
- Subgingival placement of antibiotic fibers or strips
- Initial placement of orthodontic bands, but not brackets
- Intra-ligamentary local anaesthetic injections
- Prophylactic cleaning of teeth or implants where bleeding is anticipated
- Incision and drainage or other procedures involving infected tissues

2.3. THIRD MOLAR SURGERY

2.3.1. Impacted teeth

Impacted teeth can be defined as those teeth that are prevented from eruption due to a physical barrier within the path of eruption (Farman, 2004). The term impaction was defined by Peterson as one that fails to erupt into the dental arch within the expected time (Peterson, 1998). Another definition states that an impacted tooth is one which, for various reasons does not erupt into the correct position in the dental arch at the appropriate time (Archer, 1966).

2.3.2. Etiology of impaction

The main cause of impactions is a lack of space. The third molars are the last teeth to erupt and for this reason they are the teeth mostly affected (Richardson, 1975).

Bjork et al (1956) examined the different factors which influence the lack of space in third molar eruption, and found that three factors are involved with space shortage, they are as follows

1. Reduced rate of growth in the length of the mandible, in which there is insufficient increase in the length of the mandible in proportion to the amount of tooth substance.
2. Vertical direction of the condylar growth, which is associated with insufficient resorption at the anterior ramus border.
3. Back-ward directed eruption of the dentition, which cause a decrease in space for third molars to erupt.
4. Retarded maturation of dentition is a fourth factor contributing to incomplete eruption (Björk et al; 1956).

Richardson (1980) indicated that if third molar formation is delayed beyond the age of 10 years, the possibility of all four third molars developing is reduced by about 50%. She found no significant differences in the size of early and late developing third molars.

Impaction of mandibular third molars can develop due to a decrease in the angulation of the mandible; an increase in the angulation of the mandibular plane; or third molars may remain in the same developmental angular position (Richardson, 1980). Lack of attrition and occlusal forces on the dentition associated with processed foods lead to a decreased forward movement of the

dentition, which may then prevent eruption of third molars. This theory was claimed by (Begg, 1954).

Richardson (1977), in his study found that patients with a skeletal class II occlusion were more prone to present with impacted mandibular third molars, that the mandible was smaller in patients with impacted teeth, that an acute gonial angle among patients with impacted third molars were present, and he also noted that the size of impacted third molars were larger than the erupted third molars.

The relation between the root angulation and impaction has also been studied and it was shown that angulated roots were more common in impacted mandibular third molars as compared to erupted mandibular third molars (Yamaoka et al, 1997).

Impacted mandibular third molars may be influenced genetically. Some studies showed that impacted canines and mandibular molars occur more commonly in familial settings (Peck et al, 2002).

2.3.3. Classification of impacted teeth

Most classifications of third molar impactions are based on the analysis of periapical or more commonly, panoramic radiographs. Maxillary and mandibular third molars are traditionally classified radiographically by angulation, their vertical relationship with the crown of the adjacent second molar, and, for mandibular third molars, their spatial relationship with the ascending ramus of the lower jaw (Pell and Gregory, 1933).

Predicting the degree of surgical difficulty based on traditional classifications is useful but not universally applicable. The ultimate predictors of

surgical difficulty are procedure length, postoperative recovery developments, and surgical complications. Patient factors that contribute to challenging third molar surgery can be grouped into categories of anatomy, physiology, and response to anesthesia. Obesity is an increasing health problem that affects the practice of oral and maxillofacial surgery (Winter, 1926). Advanced aged patients are more likely to be medically compromised, have atrophic mandibles, and be at greater risk for jaw fracture or poor recovery from nerve injury.

Contemporary classifications of third molars and the associated "difficulty index" described by Pedersen (1988) are not universally accepted as predictors of third molar surgical difficulty (Diniz-Freitas et al, 2006). The spatial relationship of a third molar is not as important as surgical access, balanced anesthesia, bone density, and the absence of dilacerated roots. The relationship of dilacerated root apices of a mandibular third molar to the inferior alveolar canal is a certain measure of difficulty and increased risk. A superiorly positioned developing upper third molar in close proximity to the maxillary sinus in a young patient with limited space between the maxillary tuberosity and the anterior border of the mandibular ramus predicts difficult surgery. Poorly anesthetized patients, who are moving and verbalizing can make the simplest of third molar surgeries difficult.

The Pell and Gregory classification relates the position of the impacted mandibular third molar to the ramus of the mandible in an anterior-posterior direction (Pell and Gregory, 1942), as shown in Fig-1.

When the mesiodistal diameter of the third molar crown is completely anterior to the anterior border of the ramus, it is considered a **ramus class I relationship**. Such a tooth can be angled in a mesial, distal, or vertical direction. The likelihood for normal eruption is best for a class I tooth with a vertical angulation.

In a Pell and Gregory ramus class II relationship, approximately one half the mesiodistal diameter of the mandibular third molar is covered by the ramus of the mandible. The distal aspect of the crown of teeth in this position is covered by bone and soft tissue. Teeth so positioned are particularly susceptible to caries and pericoronitis.

A **Pell and Gregory ramus class III relationship** involves an impacted mandibular third molar that is located completely within the ramus. The accessibility of a class III impaction is such that it should be considered the most difficult tooth to remove. A mandibular third molar in a class I relationship should not be difficult to remove, whereas a class II relationship would be more difficult than a class 1 relationship but less difficult than a class III relationship.
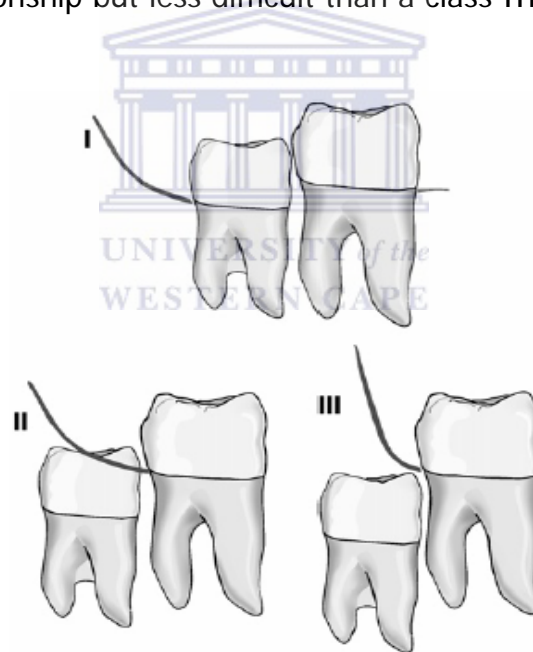
Fig-2.1 Mandibular third molars classified by their spatial relationship to the anterior border of the ascending mandibular ramus

This relationship is important because the less space there is available between the second molar and the ascending ramus the more likely it is that the third molar will be impacted.

- Class I impaction, in which mandibular third molar has sufficient room anterior to the anterior border of the ramus to erupt.
- Class II in which half of the impacted third molar is covered by the ramus.
- Class III, in which the impacted third molar is completely embedded in the ramus of the mandible.
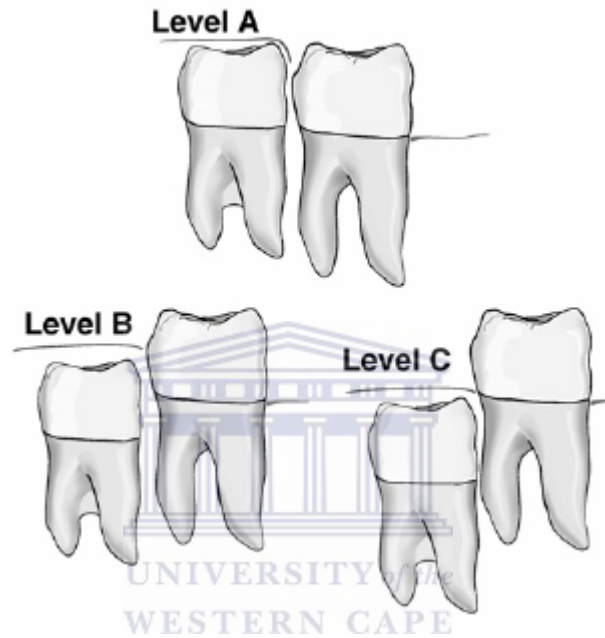
Fig- 2.2 Classification of impacted third molars according to the depth

Pell and Gregory classification based on relationship to the occlusal plane.

Level A denotes that the crown of the impacted tooth is at or above the occlusal plane of the second molar.

Level B denotes that the crown of the third molar is between the occlusal line and the cervical line of the second molar.

Level C indicates that the crown of the third molar is beneath the cervical line of the second molar.

 (Ashoo and Powers, 2000)
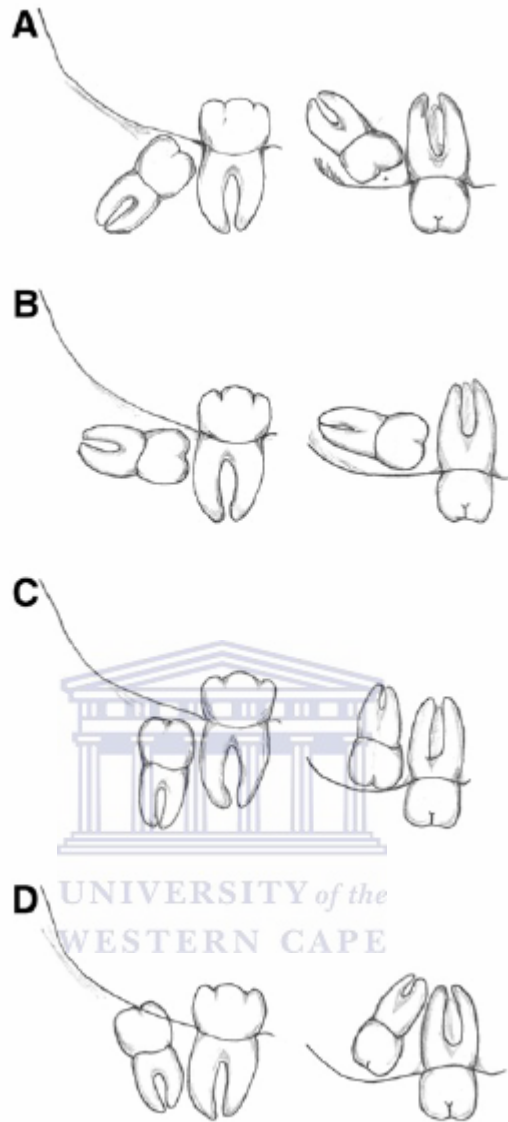
Fig- 2.3 Classification system for impacted third molars according to angulations

(A) Mesioangular lower and upper third molar impactions.

(B) Horizontal lower and upper third molar impactions.

(C) Vertical lower and upper third molar impactions.

(D) Distoangular lower and upper third molar impactions.

Classification for the maxillary third molars

Pell and Gregory classified maxillary third molars based on the relationship to the occlusal plane.

Class A, in which the occlusal plane of third molar is level with that of the second molar.

Class B, in which the occlusal plane is between the occlusal plane of the second molar and its cervical line.

Class C, in which the occlusal plainof the impaction is below the cervical line of the second molar.

(Farish et al, 2007)

2.3.4. Indications and contraindications for the removal of impacted third molars

The rising standard of living associated with health education has created a demand for preventative care, including dental surgery. Especially in the time of fluoridation, teeth has been preserved what otherwise would have been lost because of tooth decay. The preservation of the first and second permanent molars makes impaction of third molars far more likely to occur.

In 1979, a Consensus Development Conference on removal of third molars was held at the National Institute of Dental Research (National Institute of Health). More than 200 practicing dentists and scientists representing all disciplines within the profession met in an effort to reach general agreement on when and under what circumstances third molar extractions would be advised.

There are well-defined criteria for mandibular third molar removal such as recurrent peri-coronal infection, non-restorable carious lesion, cyst, tumor, and destruction of adjacent bone and tooth.

Current predictive growth studies are not sufficiently accurate to form a basis on which clinical action could be justified. Bishsra et al., (1983) in his review article concluded that there is no conclusive evidence to indict the third molars as being the major etiologic factor in the post-treatment changes in incisor alignment.

Third molars are best removed in younger patients for periodontal reasons and an expected, if not statistically confirmed, age related decrease in recovery time. The reduced morbidity resulted from extraction in younger patients than those in advanced adulthood (Van der Linden et al, 1993). Osborn et al., (1985) did a prospective study of complications related to mandibular third molar surgery and concluded that increased numbers of complications occur after the removal of older patients. On this basis they advocated the early, judicious removal of third molars.

Contra-indications for the removal of impacted third molars that should be considered are as follows:
- Possible damage to adjacent structures of an asymptomatic impacted tooth when the position is such that the removal adversely influences any adjacent structures
- Compromised health status and age of the patient
- Adequate space for eruption of the tooth
- Abutment tooth
- Orthodontic reasons – i.e. when first or second molars/premolars have been extracted
- Transplantation of the third molar to extraction site of another molar
- An unwilling patient should have his/her wishes respected

2.3.5. REMOVAL OR RETENTION OF ASYMPTOMATIC IMPACTED THIRD MOLAR TEETH (ISSUE)?

The removal of impacted mandibular third molars is one of the most common procedures in dental surgery (Marciani, 2007; AAOMS parameters and pathways version 3). There seems to be no controversy about the removal of symptomatic impacted mandibular third molars (Koerner, 1994; Erasmus, 2002 ; National Institute for Clinical Excellence, 2006), but the prophylactic removal of asymptomatic impacted mandibular third molars may be regarded as a controversial procedure (Sasano et al, 2003).

The prophylactic removal of asymptomatic impacted wisdom teeth is defined as the (surgical) removal of wisdom teeth in the absence of local disease. Some studies support the prophylactic removal of impacted mandibular third molars Koerner 1994, Mercier and Precious, 1992; Lytle 1993, Fuselier et al, 2002; Bagheri and Khan, 2007), while other studies do not advocate the prophylactic removal of impacted mandibular third molars (Song et al, 2000; Lida et al, 2004; Zhu et al, 2005; Mattes et al, 2005). These studies were based on indications, contraindications or surgical complications as a guideline to decide whether prophylactic removal should be employed or not.

A critical review of 149 published articles was done by Mercier and Precious in 1992. Comparison was made between the risks of non-intervention and the benefit of nonintervention. The risk of intervention and the benefit of intervention were also considered and all of this compared with each other. They came to the conclusion that "The case of either the removal or retention of the asymptomatic third molar in many instances, appears not to be clear cut."

Bruce and co-workers (1980) showed pericoronitis to be the most frequent reason (40%) for removal of impacted third molars in different age groups. The age incidence of pericoronitis occurs mainly between 20 and 29 years and very rarely over 35.

Of interest are the conflicting opinions on the role impacted teeth have on crowding of teeth. Stephens in 1989 stated; "clearly the removal of erupting third molars to prevent crowding of lower incisors lacks scientific support and cannot be used to justify preventative extraction". On the contrary, Lindquist (1982) extracted third molars unilaterally and found decreased crowding on the extraction side, compared with the implication of the presence of erupting third molars as one causative factor in lower arch crowding.

Song and co-workers (1997) makes a sweeping statement that; "In the absence of good evidence to support prophylactic removal there appears to be little justification for the removal of pathology free third molars." Statements such as these grant license to ignore third molars in the dental equation! Operator experience has been shown to have a direct influence on post-operative morbidity (Sisk et al 1986).

Song et al in 1997 concluded that the principle of preventive medicine should be ignored due to operator inexperience and especially financial restraints. It should be noted that asymptomatic does not necessarily mean pathology free. A deep carious tooth can be asymptomatic but certainly not pathology free.

Mettes et al, (2005) found no evidence to support or refute routine prophylactic removal of asymptomatic impacted wisdom teeth in adults. There is some reliable evidence that suggests that the prophylactic removal of asymptomatic impacted wisdom teeth in adolescents neither reduces nor prevents late incisor

crowding. Goss in his discussion contradicts the Cochrane Review. He states that, "Until there is evidence to the contrary it is recommended that non-functional wisdom teeth are best removed in teenagers and young adults. This is sound preventive dentistry."

2.4. DISCUSSION

Since the introduction of penicillin into human therapeutics in the 1940s, antibiotics have been used and misused over the past 66 years. It was the early 1950s when the debate of antibiotic prophylaxis started. One of the earliest discussions published was by Altemeire and his colleagues in 1955. He emphasized the necessity of determining the specific indications for prophylactic antibiotic therapy on the basis of existing knowledge.

2.4.1. Timing of antibiotic prophylaxis

Bruke (1961) discussed the effective period for preventive antibiotic action in experimental incisions and dermal lesions. He concluded that the antibiotics cause maximum suppression of infection if used before bacteria gain access to tissue.

The use of prophylactic antibiotics to reduce postoperative complications in third molar surgery remains controversial. Some authors favor routine prophylaxis (Zeitler, 1995; Stone, 1976; Curran 1974; Gregor, 1976). Some suggest it to be more valuable with the difficult cases; while others report no benefit (Goldberg, 1985). However, prophylactic antibiotic will only provide adequate protection when effective levels are present at the time of bacterial contamination (Stone, 1979).

2.4.2. The pioneering efforts in antibiotic prophylaxis

The efforts of Polk (1969), Burke (1961), Stone (1979) and Weinstein provide the rational for the use of antibiotic prophylaxis. Piecuch, et al in 1995 looked at the issue of antibiotic prophylaxis especially for third molar surgery. They offered that the oral surgeons prescribe prophylactic antibiotics in third molar surgery for full bony and partial bony impactions (Stone, 1976; Barclay, 1987). Neomycin-bacitracin cones were placed in impacted third molar sockets by Nordenram in 1973. He found that the postoperative complications were significantly less in those cases where these cones had been used.

His trial was randomized but not blind. This study was directed more at evaluating a local bandage than comparing the antibiotic groups with a control, making it somewhat difficult to evaluate. No recommendations for antibiotic use on routine basis were made by these authors.
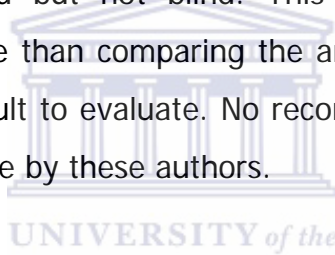
In a 1976 editorial entitled "Prophylactic Antibiotics: A problem or panacea, Laskin mentioned the inappropriate use of antibiotics. He then urged that the hospital oral surgery departments should establish specific guidelines for prophylaxis and treatment. He urged the hospitals with residency programs to teach the trainees the proper rationale behind the choice of antibiotics, the need for cultures and sensitivity tests, the complications associated with use of antibiotics and the necessity for conservatism in prescribing the drugs.

A randomized, double blind, placebo-controlled clinical trial compared tinidazole with placebo for prevention of infection after third molar surgery (Mitchell, 1986). This study found a significant difference between the incidences of infection in the tinidazole group as compared with the placebo group (Mitchell, 1986). However, the definition of infection in his study included the diagnosis of

alveolar socket and therefore the data presented in the article did not allow the reader to determine which patients actually had true infections and which had simple alveolar infection.

Capuzzi saw no statistical difference in regard to pain and swelling in their 146 patients (Capuzzi, 1994). Half of which were on postoperative amoxicillin for 4 days and half without antibiotics. The author did not comment on the infection rate. This study violated the rule of antibiotic prophylaxis that no antibiotics were in the soft tissue before the surgery.

2.4.3. LITERATURE AGAINST ANTIBIOTIC USE

Investigators, who propagate that prophylactic antibiotics should not be used, include Curran et al. They divided 68 patients, who had 133 mandibular bony impactions, into two regimen groups: 1) penicillin intramuscularly 1 hour before surgery followed by oral penicillin for 4 days; 2) no antibiotics. They concluded that the use of prophylactic antibiotics in third molar surgery is unnecessary unless specific systemic factors are present.

Curran's conclusions contradicted the results because 7.8% (5 of 64) of the sockets that were treated with antibiotics got infected whereas 8.7% (6 of 69) of the sockets without antibiotics became infected.

Happonen et a1(1990), divided 136 patients who had mandibular third molar extractions into three random groups, each of which was given an intramuscular injection 1 hour preoperatively and 15 tablets over 5 days postoperatively. Of the patients receiving penicillin, 13.6% (6 of 44) became infected, whereas 10.6% (5 of 47) who received tinidazole and 11.1% (5 of 45) who received placebo developed infections. These differences were not statistically significant.

Goldberg made the statement that "antibiotic prophylaxis is not useful in the prevention of postsurgical wound infection". However, analysis of the data in this article shows that 1.1% (1 of 90) of patients receiving antibiotics developed infections, whereas 9.4% (20 of 212) who did not receive antibiotics developed infections.

Mitchell (1986) reported an 8.8% (4 of 45) incidence in his tinidazole group versus a 45.4% (20 of 44) incidence in his placebo group. A subsequent comparison study by the same author (Mitchell, 1986) showed similar infection rates in groups given either of pivampicillin or tinidazole, but there was no control group. Some articles support the use of antibiotics on the basis of decreased trismus, swelling, pain, or better wound healing, but do not specifically comment on infection rates (MacGregor & Addy, 1980).

One randomized prospective article by Nordenram (1973) studied bacterial growth in third molar sockets of 120 patients: 40 with preoperative and postoperative penicillin, 40 with preoperative and postoperative scopolamine (to reduce salivary flow), and 40 with no medication. Growth of both aerobic and anaerobic bacteria within the sockets was significantly decreased in the group on penicillin.

2.4.4. LITERATURE IN FAVOUR OF ANTIBIOTIC USE

Investigators who favor the use of antibiotics include those commenting on direct application within sockets as well as those favoring systemic antibiotics. Antibiotics placed directly into the socket, including tetracycline, metronidazole, lincomycin and oxy-tetracycline, have been shown to be very effective in reducing significantly the incidence of alveolar osteitis (dry socket), whereas one prospective, double blind study comparing 85 patients with neomycin/bacitracin

cones with 59 controls showed a 7.1% infection rate in the antibiotic group and a 20.3% rate in the control group Nordenram (1973).

Only one article other than Goldberg's (1985) could be sourced dealing with the use of systemic antibiotics and rates of infection. In the articles that documented a higher incidence of infection, every patient was examined after surgery. None of the three articles with a lower incidence makes that statement. It is possible that some infections in these groups were not identified as all patients were not examined post-operatively.

Piecuch (1995) in his retrospective study of 6,713 third molar teeth, demonstrated that antibiotics appear not to be of benefit in some instances and are of significant benefit in other instances. The strength of his study was that it was the only published study with a large number of patients where all patients were evaluated postoperatively. Infection rates by site, by classification of impaction and by comparison of different antibiotic regimens were documented. The weakness of his study was its retrospective and nonrandomized nature (Lawler, 2005; Martin, 2005).

In another double blind, prospective, placebo-controlled trial used metronidazole 1-gram orally one hour preoperatively (44 patients), metronidazole 400mg orally eight-hourly for five-days (47 patients), placebo (34 patients), concluded that antimicrobial prophylaxis does not seem to reduce morbidity after removal of lower third molars (Sekhar,2001).

In 2004, Poeschl and Eckel evaluated the need for prophylactic postoperative oral antibiotic treatment in the removal of asymptomatic third molars. His study was prospective and randomized. He used 288 patients with 528 third molar

extractions. He found no benefit for post-operative oral prophylactic treatment after the removal of asymptomatic third molars.

Although the study indicates that antibiotics were given prophylactically, the timing of administration after surgery violates a basic principal of prophylaxis that the antibiotic should be within the tissues at the beginning of surgery. In this study the patients were given antibiotics post-operatively. The length of time for which antibiotics were given (5-days) should be addressed (Lieblich, 2004; Pallasch, 1989 i.e. he used antibiotics for 5 days post-operatively.

2.5- CONCLUSION

Third molar surgery is a common surgical procedure. Antibiotic prophylaxis in third molar surgery is the debate of the day and remains controversial (Pogrel, 1993; Poesch, 2004; Pallasch, 1989; Poesch, 2004). Thus, a review of the literature reveals no clear-cut guidelines. Most of the articles discouraging antibiotic use are flawed in either scientific method or conclusions. Even the incidence of infection as quoted in the literature, seems to be contradictory. Many dental and oral surgical textbooks recommend against the use of prophylactic antibiotics for extractions, including third molar surgery, unless active infection is present at the time of surgery. Others recommend routine antibiotic use only for "deep, difficult impactions, and, for a minimum of 5 to 7 days".

A number of other studies have had less stringent protocols, oftentimes randomizing groups but not doing blind studies. These studies had a tendency to find more favorable outcomes in the antibiotics groups.

Bystedt and Nord (1980) evaluated four different antibiotics versus placebo observing pain, trismus, swelling, and wound healing. They found that antibiotics significantly reduced pain on day 7 postoperatively. In general, they found no statistically significant differences in trismus and swelling. Hever, there was a significant difference between the placebo and doxycycline groups with respect to swelling (day 2 postoperative, $P < 0.01$; day 5 postoperative, $P < 0.05$). They concluded that systemically administered antibiotics offered only slight advantages in routine operations of impacted third mandibular molars, but could decrease the rate of infections after traumatic operations.

Krekmanov and Hallander (1980), using a randomized trial that was not blind, compared penicillin with scopolamine and a control group, monitoring incidence of alveolitis only. The frequency of alveolitis after third molar surgery was studied in three groups of 40 patients each. One group was pre-medicated with penicillin V, another with scopolamine, and the third group received no pre-medication. The respective frequencies of alveolitis were 5, 2.5 and 32.5 % (P less than 0.01 and P less than 0.001). In this study, penicillin resulted in a decreased incidence of alveolitis.

In the latest review article (Antibiotic prophylaxis for dentoalveolar surgery: is it indicated), Lawler (2005) states that there are no randomized controlled clinical studies of antibiotic prophylaxis for dentoalveolar surgery, including third molar removal and dental implantation. Other less rigorous studies show conflicting or equivocal results.

This literature review has attempted to evaluate the use of antibiotic therapy for third molar surgery. The incidence of postoperative infection ranges from 1% to less than 6% (Peterson, 1990; Laskin, 2003), with most of those being minor infections. This low complication rate would not support the routine use of

antibiotic prophylaxis if you follow the basic principle of prophylaxis. In addition, the potential for adverse reaction to antibiotic therapy exceeds any possible decrease in infection. Studies that have compared infection rates after use or non-use of antibiotics do not show decreased infections in the antibiotic groups.

The literature review would support a study to assess the value of prophylactic antibiotic in third molar surgery. The objective of this study was to establish specific guidelines for prophylaxis in third molar surgery for the department of Maxillo-Facial and Oral Surgery at Tygerberg Academic, Groote Schuur and Mitchells Plain hospitals.

CHAPTER 3

AIM AND OBJECTIVES

Aim:

- To evaluate the potential value of prophylactic antibiotics in third molar surgery.

Objectives

- To evaluate the frequency of post-operative complications in third molar surgery.
- To compare the rate of post-operative complications between the two groups and a placebo.
- To recommend specific guidelines for prophylaxis of third molar surgery in the department of Maxillo-Facial and Oral Surgery at Tygerberg Academic, Groote Schuur and Mitchells Plain hospitals.

Null hypothesis

There will be no difference in post-operative complications in patients with or without antibiotic prophylaxis in third molar surgery.

Rationale

- Third molar surgery is a common surgical procedure. Antibiotic prophylaxis in third molar surgery is the debate of the day and its use is controversial.
- The motivation for the study comes from the number of patients who go through third molar surgery every year.
- This research is relevant in that it will set guidelines for antibiotic prophylaxis in third molar surgery for Maxillofacial and Oral Surgery department at Tygerberg Academic, Groote Schuur and Mitchells Plain hospitals for the management of their patients.

CHAPTER 4

MATERIALS & METHODS

4.1. Study Methodology

4.1.1 Study Design:

The study was a prospective, randomized, double blind, placebo-controlled clinical trial in which the patients acted as their own control (cross over). They were randomly assigned into two groups. Two third molars were removed under antibiotic cover and the other two were removed without antibiotic cover. Neither patient nor surgeon was aware which teeth were removed under antibiotic cover. The exact nature of the medication was not revealed to the patients or surgeon. The capsules were of same shape, size and color and were filled with either antibiotic or placebo. Randomization was conducted by the well-trained hospital nursing staff during the entire period of the double blind study.

4.1.2. Study population:

Patients with four impacted third molars on waiting list for third molar surgery, at Oral Health Centre, Tygerberg Academic Hospital, were included in the study

4.1.3. Sample Size

One hundred patients with four impacted third molar were invited to take part in the study. The patients were paired using radiographs and the Pell and Gregory classification and then assigned to two groups. Each patient acted as its own control.

4.2. Methodology

Group- I received 1 gm of amoxicillin, 1 hour before surgery (pre-operatively) only on the first surgical visit. On the second surgical visit placebo capsules (capsules of same shape and size with glucose in it) were given or vice versa.

Group-II received 1 gm of amoxicillin, 1 hour before surgery and then 500 mg 8 hourly for two days (the current regimen) on the first surgical visit. On the second surgical visit placebo capsules (capsules of same shape and size with glucose in it) were given or vice versa.

Prior to the trial, each patient was informed about the study, its aim, implications and possible complications. Signed informed consent was obtained. The patients were examined clinically and those with infections or on antibiotics were excluded. The angulations and depth of the third molars were recorded from the pantomograph using the Pell and Gregory. The Pell and Gregory system classifies the relative depth of impaction on the basis of its vertical relationship to the second molar and the ramus.

Surgery was carried out under local anaesthesia using a standard operative technique for all patients.

4.2.1. LOCAL ANESTHESIA (LA)

The inferior dental (inferior alveolar nerve and long buccal blocks) as well as local infiltration are the main stay of LA in mandibular third molar surgery. The aim is to deposit the LA solution around the inferior alveolar nerve as it enters the mandibular foramen at the lingula. The long buccal nerve was anaesthetized

by injecting 0.5-1 ml of LA posterior and buccal to the last molar tooth. For the maxillary buccal and palatal infiltration anaesthesia was used.

4.2.2. SURGERY

Surgery was performed by raising an envelope mucoperiosteal flap. If indicated, bone was removed on the buccal and distal aspect of the third molar with a no 8 round surgical burr under constant sterile 0.9% saline irrigation. Tooth elevation, crown removal and or root division and elevation were done as required. After removal of the tooth the surgical field was meticulously rinsed with sterile 0.9% saline. The wound was closed by placing 3-0 Vicryl® interrupted sutures.

A standard regime of analgesics (ibuprofen 400mg pre-operatively, ibuprofen 400mg 6-hourly for 2 days) plus paracetemol 500mg and codeine phosphate 8mg 6-hourly for 2 days) was used. A mouthwash (0.2% chlorhexidine gluconate 10ml stat, pre-operatively and 8-hourly for 3 days), was given to all patients. Tilidine-HCl, (50mg) was used as an escape analgesic (maximum three capsules).

4.2.3. PATIENT SELECTION

Inclusion criteria

1- American Society of Anesthesiologists (ASA) Class I patients between 17-40 years of age and gender, and race

2- Patients with four impacted third molars

Exclusion criteria

1- Patients with active pericoronitis or infection

2- Blind patients as they can not use a Visual Analogue Scale

3- Patients with blood dyscrasia or using anticoagulants

4- Patients with rheumatic heart disease

5- Patients with associated third molar pathology

6- Patients using homeopathic or alternative medication for any reason

7- Immunocompromised patients

8- Mentally challenged patients

9- Patients who have used antibiotics in the past 14 days

10-Patients allergic to penicillin

4.2.4. CRITERIA FOR EVALUATION

<u>**Pain**</u>

To allow a continuous assessment of pain, visual analogue scale uses a 10 cm line labeled at '0' with 'no pain' and '10' with 'worst'. The line is marked at a point corresponding to the assessment of the pain. The distance of the mark from zero is measured.

In this study, pain severity was recorded on a Visual Analogue Scale (VAS). Pain was recorded three times a day for two weeks. Patients were instructed to rate and record pain intensity on the VAS.

<u>**Pain**</u>

Variables	*Score*
None	0
Mild	1
Moderate	2
Severe	3
Could not be worse	4
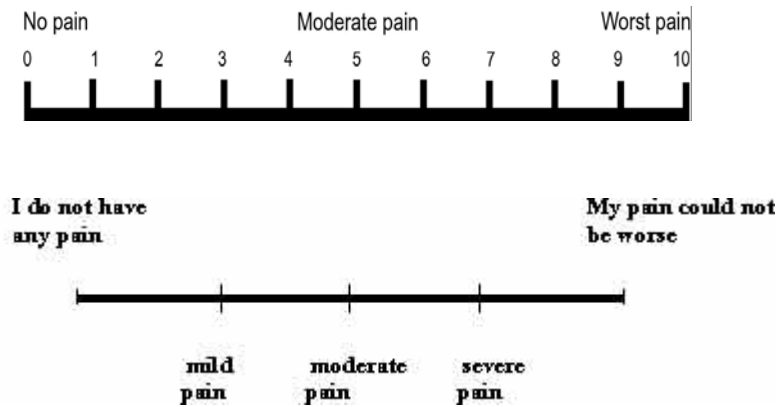
Figure-4.1 Visual analogue scale/graphic rating scale

Swelling

Swelling was measured pre-operatively, after 3 days, 7 days and after two weeks post-operatively.

Variables	Score
None (absent)	0
Mild (just visible and palpable)	1
Moderate (obvious)	2
Severe	3

Trismus (in mm)

Maximum mouth opening ability was measured in millimeters between the upper and lower right central incisors using Vernier-calibrated sliding calliper pre-operatively, and on every visit.

Trismus (Difference in mouth opening in mm)

Variables	Score
Non	0
1-5 mm	1
6-10 mm	2
11-15 mm	3
16-20 mm	4
>20 mm	5

Temperature (> 38 ° C)

Temperature was recorded pre-operatively and on every visit.

Temperature >38°C was considered a fever.

Temperature   (>38°C)

Variables	Score
No	0
Yes (>38° C)	1

Pus collection and/or discharge

Clinical signs of pus collection were recorded on every visit.

Clinical collection of pus

Variables	Score
None	0
Yes	1

Dry socket

Patients were evaluated for dry socket at each visit, halitosis, pain, clinical signs of clot less socket with necrotic bone were used as diagnostic criteria.

<u>**Dry socket**</u>

Variables	*Score*
None	0
Yes	1

The Pell & Gregory Classification

In 1923 Pell and Gregory demonstrate on tooth division technique for the removal of impacted teeth. Ten years (1933) later, they published their first article in which they also classified the third molar impactions into different groups i.e. according to the relation of the tooth to the ramus of the mandible, relative depth of the third molar in the bone. They also demonstrate the position of the third molar in relation to the long axis of the second molar using Winters' classification.

<u>Relative depth of the third molar in the bone</u>

Depth A

The occlusal plane of the impacted tooth is at the same level as the occlusal plane of the second molar.

Depth B

The occlusal plane of the impacted tooth is between the occlusal plane and cervical line of second molar.

Depth C

The impacted tooth is below the cervical line of second molar.

<u>According to the relation of the tooth to the ramus of the mandible</u>

Class I

There is sufficient space between the ramus and the distal part of second molar for accommodation of the mesio-distal diameter of the third molar.
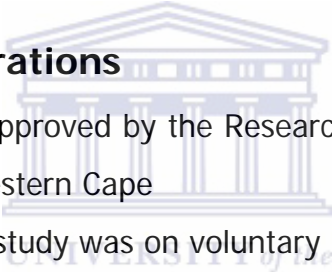
Class II

The space between the second molar and the ramus of the mandible is less than the mesiodistal diameter of the third molar.

Class III

All or most of the third molar is in the ramus of the mandible.

4.3- Ethical Considerations

- This proposal was approved by the Research and Ethics Committee of the University of the Western Cape
- Participation in this study was on voluntary basis
- Patients were adequately informed about the objective of the trial
- Written informed consent was obtained from every patient
- Patients with any other dental problems were referred to the appropriate departments
- Participants had the right to withdraw from the study at any stage and this would not prejudice them in regard to future treatments
- The rights of patients were protected at all times

4.4- Data management and statistical analysis

The data was tabulated on an excel spreadsheet and was analyzed using a commercially available statistical software package (SPSS 15.0, SPSS Inc.). Original data was supplied to the statistician.

- The Chi square test was used to compare the proportion of the nominal variables among the two treatment groups
- Fisher's Exact Test
- Non-parametric analysis of variance was used to identify any significant variables in the two groups

4.5- Budget

- Statistical analysis   R 8,000
- Drugs   R 2,000
- Research assistants   No cost
- Miscellaneous(Printing,papar)   R 5,000

CHAPTER 5

RESULTS

5.1. DEMOGRAPHIC CHARACTERISTICS

Hundred patients (62 females and 33 males) were included in the study. Mean age of the study population was 26 years (range 17 to 37). Surgery was performed on 100 patients but only 95 patients completed the study protocol (five patients left the study because of their personal reasons).

Three hundred and eighty impacted third molars were removed from the two groups(192 in group I and 188 in group II). There was no significant difference between the two groups in regard to degree of eruption, degree of impaction or difficulty of removal.

5.2. IMPACTIONS ACCORDING TO THE CLASSIFICATION SYSTEMS

A total of 138 bony (Class II & III) impacted mandibular third molars and 75 maxillary bony (Class II & III) impacted third molars were removed in the study. Fifty three Class I mandibular third molar impactions and 115 impacted maxillary third molars were removed.

In the maxilla, 62 impacted third molars were below the cervical margin of the second molar, while only 6 impactions in the mandible were below the cervical margin of the second molar. There were 107 vertical impactions in maxilla compared to 32 in the mandible.

No horizontal impactions were found in maxilla but 13 impacted third molars were horizontally impacted in the mandible. Mesio-angular impactions in the mandible showed the same patern. There were 73 mesioangular impactions in the mandible and only 23 in the maxilla.

5.3. INFECTION PREVALENCE IN THE TWO GROUPS

The association between the use of antibiotic therapy and tested variables was evaluated by using the Chi square test and the Fisher exact test as shown in table I & fig 5.1. Multiple logistic regressions was used in order to identify the variables useful in predicting pain, swelling, trismus, clinical collection of pus and dry sockets.

Only 6 post-operative infections were recorded in 380 sockets. In group I [one dose of antibiotics (1 gm) only and control], three infections were recorded of which two were in the placebo group and one in the stat group. No infection was recorded on the 7th and 14th day of surgery in this group. One infection was recorded three weeks after surgery in the placebo group (table II).

In group II, only 2 infected sockets were recorded. One patient was on antibiotics and the other on placebo capsules. Both of these infections were recorded on the 3rd day after surgery. It is interesting to note that both the infections occurred on the same patient.

Table I – Infections in different treatment groups at day 3 of surgery

Treatment Group	Infection day 3	
	No (%)	Yes (%)
One dose of 1gm only	97.9	2.1
Placebo of group I	95.8	4.2
Two days of antibiotics	97.9	2.1
Placebo of group II	97.9	2.1
Total	97.4	2.6

Table I shows the occurrence of infection after 3 days of surgery in the treatment groups

Number of infections on day 3 of surgery

■ One dose of 1gm only   ■ Placebo of group I
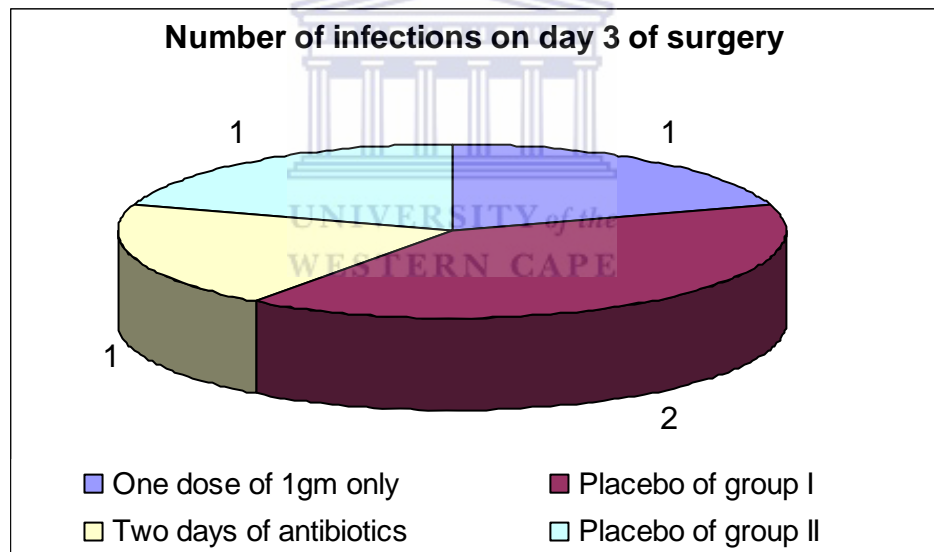□ Two days of antibiotics   □ Placebo of group II

Figure- 5.1 Total number of infections in the treatment groups on 3rd day of surgery

Table- II Treatment Group I & II Infection day 7

	Infection day 7	
Treatment Group	No (%)	Yes (%)
One dose of 1gm only	100	0
Two days of antibiotics	97.9	2.1
Total	98.9	1.1

Table II shows prevalence of infection in the two treatment groups after seven days of surgery. No infection was found in group I compared to one in group II.

5.4. Post-Operative Swelling

Swelling on the 3rd day after surgery

Group I

In group I, 37 patients presented with no swelling , 5 patients had mild and only one patient presented with severe swelling. In the placebo group 18 patients had no swelling, while 15 patients showed mild and moderate swelling on the third day after surgery.

Group II

Twenty two patients in group II had no swelling. Eighteen patients presented with mild swelling and only one patient with severe swelling. Swelling acording to the classification system are shown in fig 5.2 and 5.3. Twenty patients of the pacebo subgroup presented with mild swelling and 10 with moderate swelling on the third day after surgery. Two patients had severe swelling in this group.
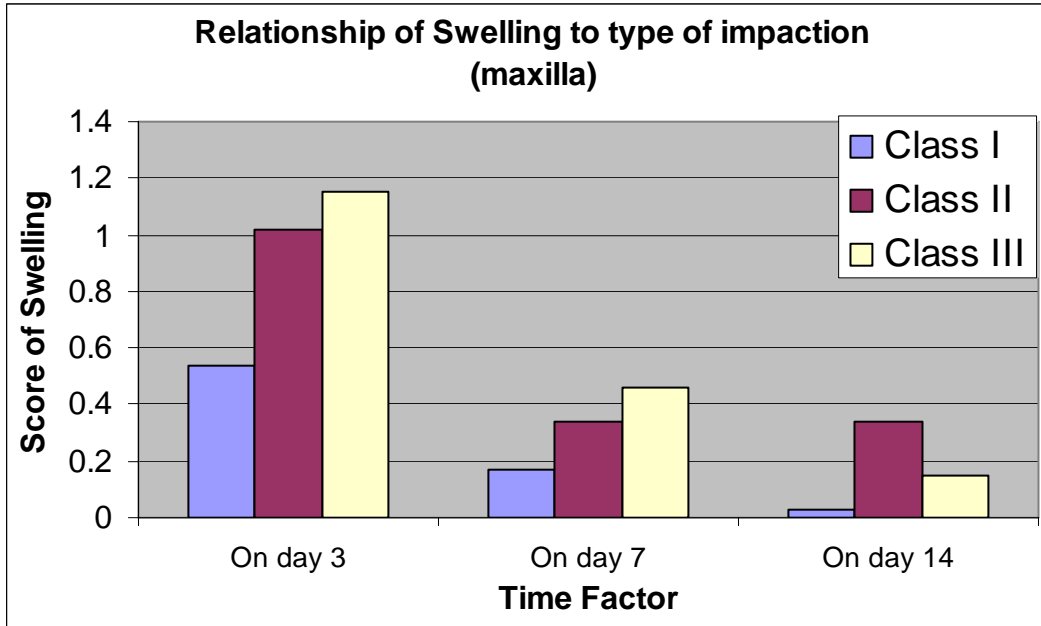
Figure- 5.2 Relationship of swelling to the type of impaction
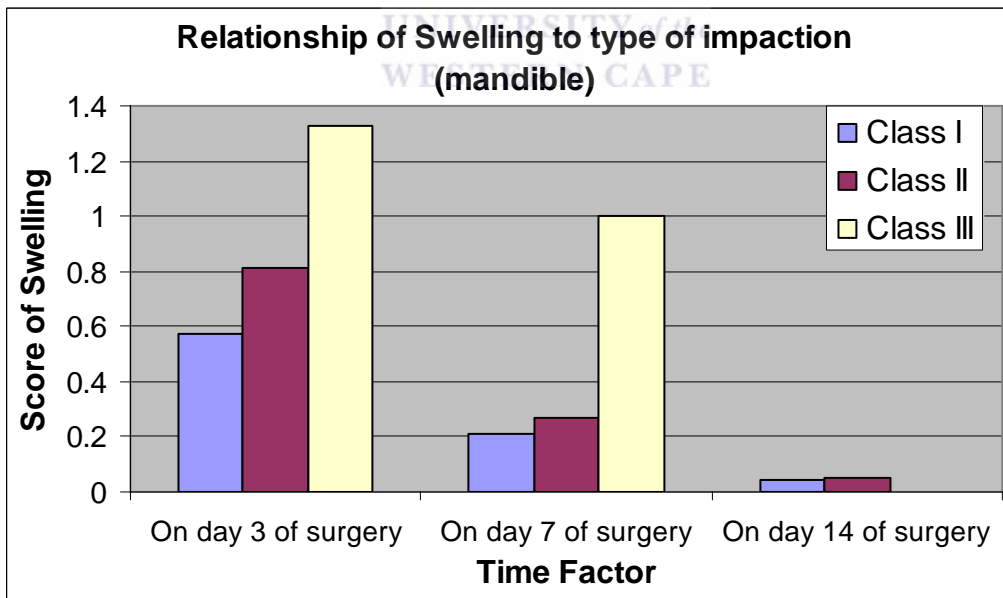
Figure- 5.3 Swelling in relation to time in different treatment groups

Swelling on 7th and 14th day after surgery

Forty two patients in group I and 36 patients in group II presented with no swelling on the 7th day after surgery. Five patients in group I and 9 patients in group II presented with mild swelling on the 7th day after surgery. Thirty seven patients in placebo group I and 32 patients in placebo group II had no swelling (Fig 5.4).

Three patients in placebo of group II developed severe swelling on the 3rd day after surgery. Placebo of group I showed no swelling on the 14th day after surgery. Four patients in group II (placebo) presented with mild swelling on 14th day after surgery as shown in fig 5.5 and 5.6.

In group I and group II, the results indicate that there is a significant time effect ($p < 0.001$). This means that the swelling score changes over time i.e. swelling score decreased with the passage of time. The results also indicate that there is a significant time treatment group interaction ($p < 0.05$). However, there is no significant evidence of treatment group effect ($p > 0.05$). Thus, the swelling scores in the two treatment groups are not statistically different i.e. p value > 0.05.
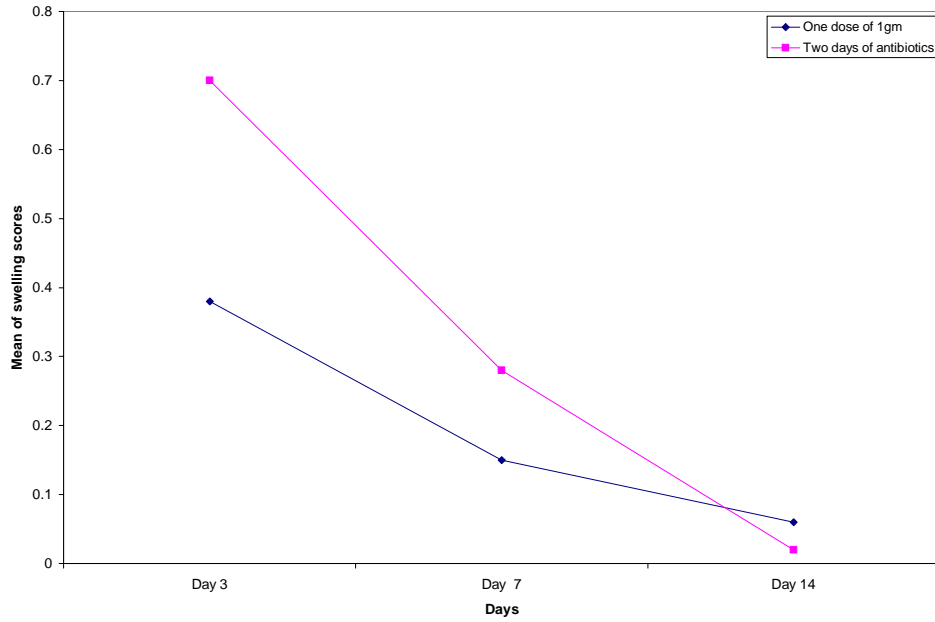
Figure-5.4 Relationship of swelling to days in the two groups
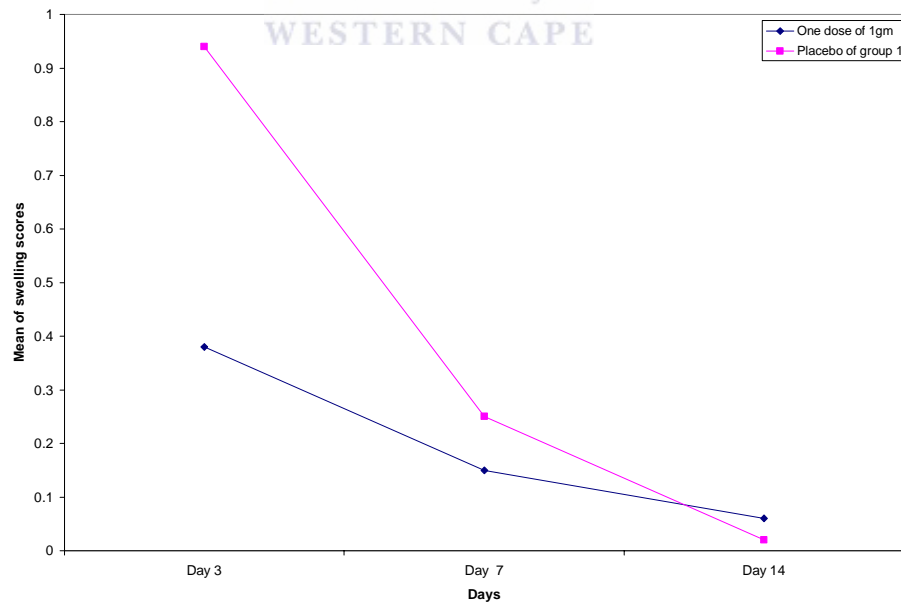
Figure- 5.5 Relationship of swelling to days in group I
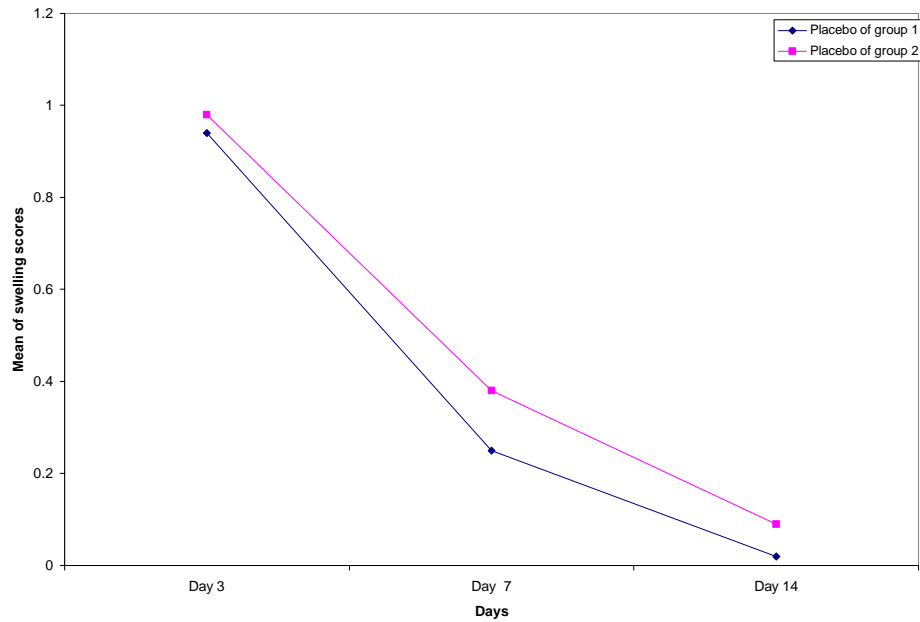
Figure– 5.6 Swelling among the placebos of two treatment groups (I & II)
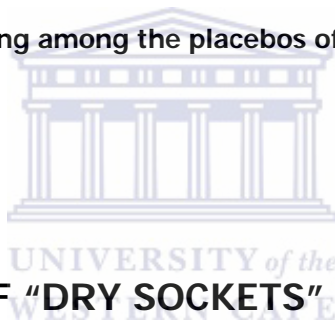
5.5. PREVALENCE OF "DRY SOCKETS"

Only one patient from Group I presented with a dry socket on the 7th day after surgery.

5.6. ADVERSE REACTIONS TO MEDICATIONS

No adverse reactions were found in the study. A few patients had minor complaints of constipation. This is a side-effect of codein phosphate.

5.7. TRISMUS

Trismus on the 3rd day after surgery

Group I

Eleven patients in this group showed no difference in maximum mouth opening before and after the surgery. Only 3 patients presented with severe trismus on the 3rd day after surgery. In the placebo of the same group, 10 patients had no trismus and 6 patients presented with severe trismus 3 days after surgery.

Group II

In the antibiotic group only 2 patients had no difference in the maximum mouth opening before and after surgery. Four patients had maximum trismus on the 3rd day of surgery. One patient in the placebo sub group, showed no signs of trismus and 6 patients had severe trismus on the 3rd day of surgery (fig 5.7).
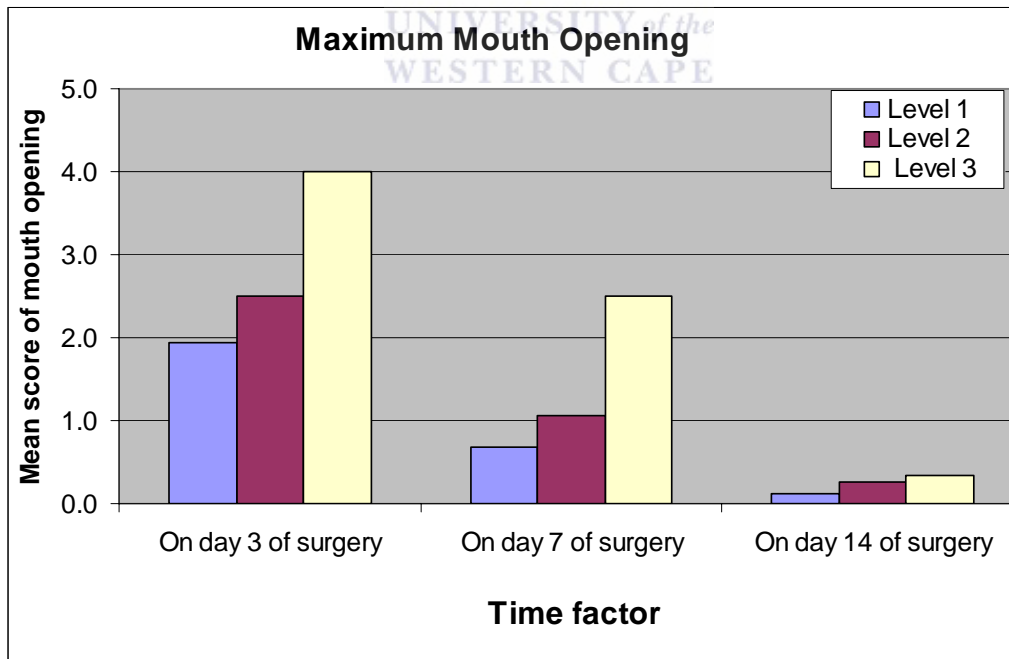
Figure- 5.7 Relationship of maximum mouth opening to time

Trismus on the 7th and 14th day after the surgery

Group I

Two patients had severe trismus on the 7th day while 32 patients remained trismus free. On the 14th day, only one patient documented mild trismus. In the placebo of group I, 25 patients had no trismus and only 1 patient showed severe trismus on the 7th day. Five patients of placebo of this group showed mild swelling.

Group II

Only one patient in the group II presented with severe trismus on the 7th day while 11 patients showed mild trismus on the 14th day after surgery. In the placebo of the same group only one patient showed severe trismus on the 7th day while 14 patients had with mild trismus on the 11th post-operative day.

The results indicate that there is a significant time effect ($p < 0.001$) as shown in table VIII. This means that the trismus scores change over time. The results also indicate that there is a significant time and class interaction ($p < 0.05$). While the trismus scores in class I and class II are not significantly different ($p > 0.05$), these results suggest a significant difference between class I and class III as well as between class I and class III ($p < 0.05$) as shown in fig 5.8 and 5.9.
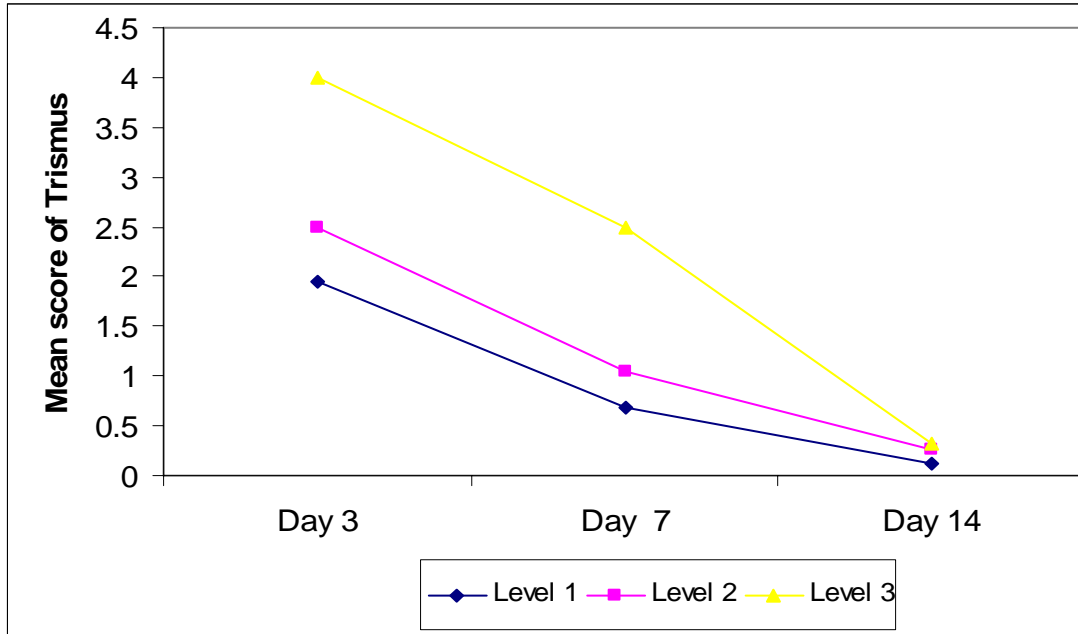
Figure- 5.8 Relationship of trismus to days in mandibular teeth according to level of impaction
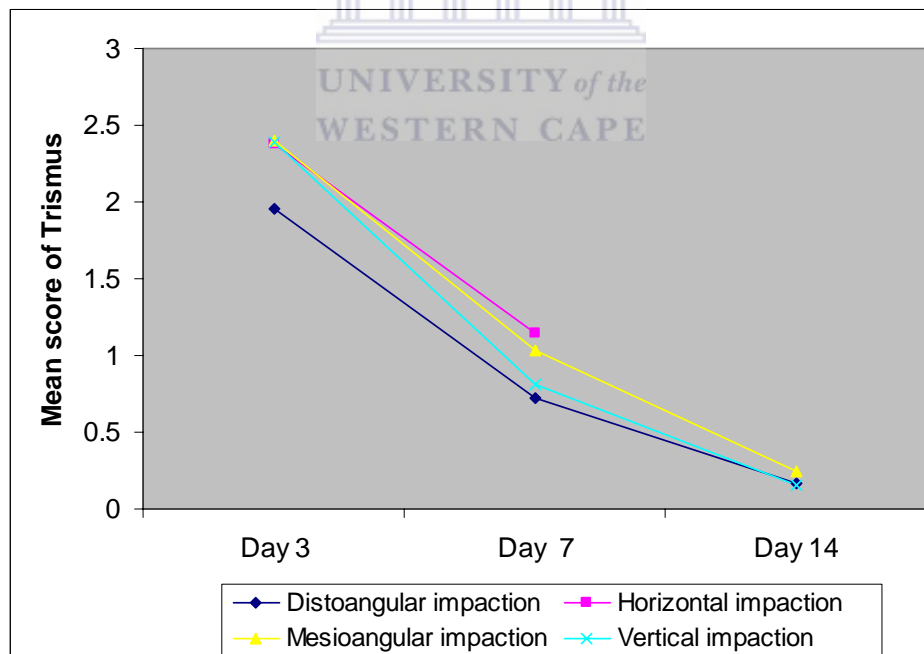
Figure- 5.9 Relationship of trismus with time in impacted third molars according to Pell and Gregory classification

The results shows that there were time effect (p-value<0.001) and pain changes over time. No statistically significant difference was found between the two treatment groups (p-value >0.05) after applying repeated measure analysis of variance as shown in figure 5.10.
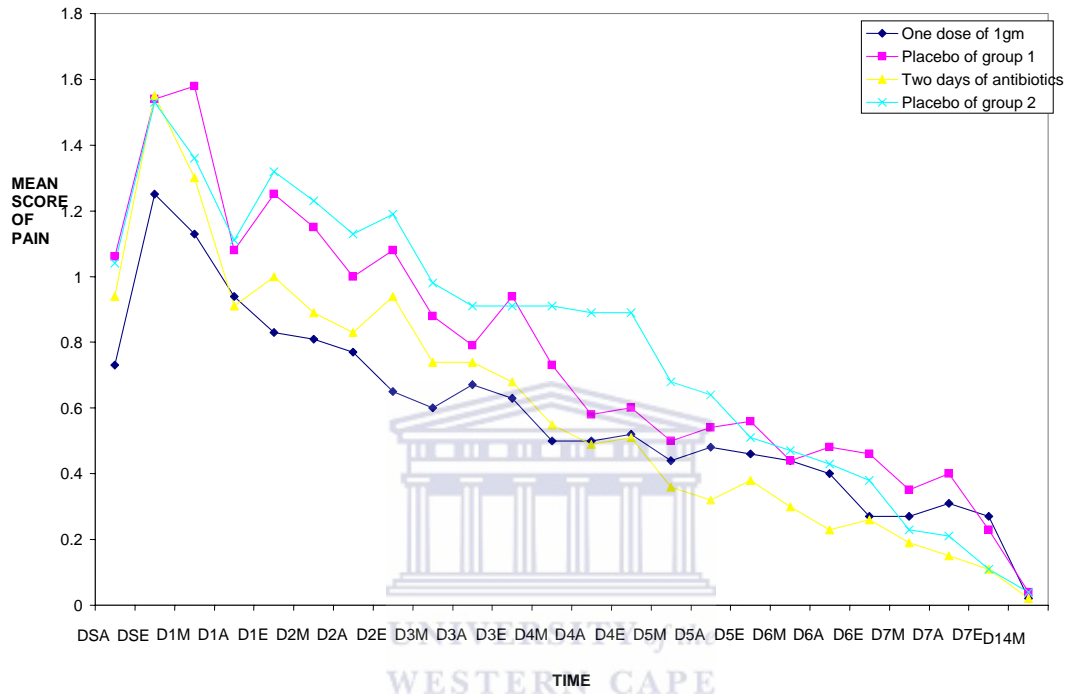
Figure- 5.10 Pain with time factor in the different treatment groups

5.7. Paresthesia after surgery

Among the 95 patients, only two (one in group I & II respectively) patients presented temporary inferior alveolar paresthesia. Paresthesia in both patients was recovered within two weeks post-operatively.

CHAPTER 6

DISCUSSION

The findings in this study were based on periodical clinical examinations. As anticipated, there was a good correlation between the patients' own assessments of pain on a VAS with the difficulty of impacted third molar. Most patients, who reported swelling, also had impaired mouth opening (Trismus).

The methods we used to evaluate pain, swelling, trismus and infection are described in the literature. Inter-examiner variability was excluded by using only one research assistant. All assessments were done in the same clinical environment.
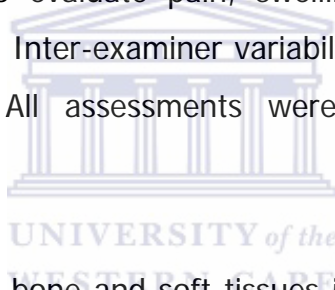
Post-operative infection of bone and soft tissues is a common complication that can be reduced with good surgical techniques. Some bacterial contamination of a surgical site is inevitable, either from the patient's own bacterial flora or from the environment. Antibiotics are commonly administered prophylactically for major and minor surgical procedures. In many cases, antibiotics are prescribed only after the procedure. No intra-operative antibiotic cover is thus achieved which is in conflict with the basic principles of prophylaxis.

In 1970 Paterson and his colleagues questioned the value of prophylactic antibiotics in third molar surgery. Nordenram et al (1973) used Neomycin cones in impacted third molar sockets and found them useful to prevent postoperative complications and infection. Later, in 1974 Curran et al, in a double blind study, concluded that the use of prophylactic antibiotics in third molar surgery was

unnecessary unless specific systemic factors were present. In 1976, Laskin urged hospital oral surgery departments to establish specific guidelines for prophylaxis and treatment. Thirty years later, Poeschl et al (2004) in his randomized controlled trial, concluded the same results as those of Curran in 1974.

There was growing concern in the department of Maxillo-Facial and Oral surgery at University of the Western Cape about the misuse of antimicrobials in the removal of wisdom teeth. Therefore it was decided to investigate the value of antibiotics in third molar surgery.

Early studies led to the recognition that reducing the amount of bacteria in the wound lowers the infection rate. Prophylaxis is aimed at a reduction of surgical site infection (SSI) by preventing local growth of potential pathogens in the tissues. Prophylaxis is mainly shown to be effective in reducing incisional surgical site infections. A significant lowering of the incidence of SSI results in several advantages:

- Decrease of post-operative stay
- Decrease in therapeutic use of antimicrobial drugs thereby minimizing adverse affects of antimicrobials
- Cost containment benefits

[Guideline for prevention of surgical site infection 1999, (Alicia J, et al 1999)]

It is important to emphasize that surgical antibiotic prophylaxis is an adjunct to and not a substitute for good surgical technique. Antibiotic prophylaxis should be regarded as one component of an effective policy for the control of hospital-acquired infections.

There have been a large number of studies of surgical prophylaxis to provide scientific evidence to guide clinicians as to the surgical indications, choice, route,

and duration of antibiotic prophylaxis, and a number of guidelines have been published on this topic (Mangram et al, 1999).

In this study we followed the guidelines of surgical wound prophylaxis by using antibiotics 1 hour pre-operatively.

Pallasch (2003) in his article, mentioned that "No clinical studies have adequately document the efficacy of peri-operative (begun before and stopped shortly after the surgery) antibiotic prophylaxis in the prevention of orofacial infection".

In this study we used two groups, group I with single loading dose of one gram of antibiotics only and group II with one stat dose of antibiotics plus two days regimen, by using the split mouth technique in which each group acted as its own control. We are convinced that such a randomized controlled trial has never been implicated earlier to evaluate the efficacy of antibiotic prophylaxis in third molar surgery.
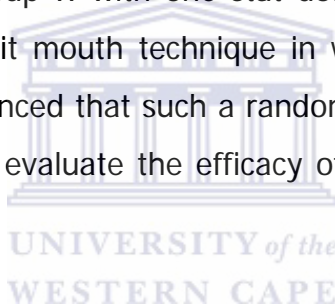
Most odontogenic infections are poly-microbial and are composed of at least two predominating bacteria, commonly streptococci, anaerobic gram-positive cocci and anaerobic gram-negative rods. Most antibiotic regimens used in dentoalveolar surgery fail to meet the key criteria of surgical prophylaxis (Burke, 1961; Stone et al, 1979). Jaunay et al in 2000 mentioned that most of the antibiotics are prescribed in relatively low dose over a long period.

Penicillin is still the gold standard in treating dental infections. Penicillin has contributed to a dramatic decrease in mortality in serious odontogenic infections such as Ludwig's angina and diffuse orofacial cellulites (James & Wendy 2003).

One of the aims of rationalizing surgical antibiotic prophylaxis is to reduce the inappropriate use of antibiotics thus minimizing the consequences of misuse.

Rates of antibiotic resistance are increasing in all hospitals (Gold and Moellering, 1996). The prevalence of antibiotic resistance in any population is related to the proportion of the population that receives antibiotics, and also the total antibiotic exposure (McCaig and Hughes, 1995).

An additional problem is the dramatic increase in the number of cases of colitis caused by clostridium difficile. The prevalence of clostridium difficile infection is related to total antibiotic usage and in particular, to the use of 3rd generation cephalosporins. In epidemiological studies of clostridium difficile colitis, surgical antibiotic prophylaxis is the single most common indication for use of antibiotics (Jobe et al, 1995).

In a study, Namias et al has shown a statistically significant increase in the frequency of bacteraemia and infections in surgical patients who received prophylactic antibiotics for more than four days in comparison with those who received prophylaxis for one day or less (Namias et al, 1999).
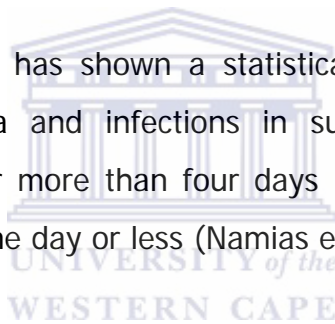
Side effect most often encountered is penicillin hypersensitivity, which is found in roughly 3-5% of the population. Anaphylactic reactions occur in 0.04-0.011 percent of patients receiving penicillin for prophylaxis. Gastrointestinal tract upset, colonization of resistant or fungal strains, cross reactions with other drugs and other allergies, are also associated with antibiotic therapy.

Because of their ineffectiveness against the oral anaerobes, macrolides are no longer considered among the empiric antibiotics of choice for odontogenic infections (Flynn and Halpern, 2003). On the other hand penicillin resistance has not been shown to be a significant problem in outpatient odontogenic infections.

In this study we excluded patients who were allergic to penicillin. Four patients of the study sample presented with infection on the third day after surgery and

two patient presented infection after three weeks (late infection). We recorded four infections in placebo group and two infections in the antibiotic group. These infections were managed by incision, drainage and rinse with normal saline. A 5 day course of antibiotics (amoxicillin, 500mg caps 8 hrly and metronidazole 400 mg tabs 8 hrly) were prescribed. The patients were symptom free after 48 hours. No adverse reactions of antibiotics were found in 95 patients.

The final decision regarding the benefits and risks of prophylaxis for an individual patient will depend on:

- The patient's risk of surgical site infection
- The potential severity of the consequences of surgical site infection
- The effectiveness of prophylaxis in that operation
- The consequences of prophylaxis for that patient (e.g. increased risk of colitis)

The period for surgical site infection begins at the time of incision. The time taken for an antibiotic to reach an effective concentration in any particular tissue reflects its pharmacokinetic profile and the route of administration (Martin, 1994). Administration of prophylaxis more than three hours after the start of the operation, significantly reduces its effectiveness. Classen et al suggested that in order to obtain maximum effects, it should be given just before or immediately after the start of the operation (Classen et al, 1992).

Prophylaxis should therefore be confined to the peri-operative period (i.e. administration immediately before or during the procedure). Post-operative doses of antibiotic for prophylaxis should not be given. Any decision to prolong prophylaxis beyond a single dose should be explicit and supported by evidence based protocols.

Out of 380 impactions, only six sockets become infected and there was no statistically significant difference between the two groups (I & II), i.e. p value >0.05. Infection rate was 1.57% which demonstrates that third molar surgery is a clean contaminated surgical procedure as described by Peterson in 1990.

A number of reports during the past few decades have dealt with the use of antibiotics in third molar surgery. Researchers used different antibiotic regimens. Most researchers used amoxicillin, metronidazole, clindamycin, cephradine, tinidazole / pivampicillin, clvulanic acid and doxicycline (Falconer, 1992; Gill and Scully 1988). They found infection rates ranging from 1.0% to 27% (Lawler, 2005). However, over all incidence of infection from third molar extraction has been reported to be in the range of 3% to 5% (Osborn et al, 1985; Goldberg et al, 1985; Susarla et al, 2003).

It has been suggested by Osborn et al (1985) that the rates of post-operative infection are higher for mandibular bony impactions than for any other type of extractions, as result of increased trauma. Surgical experience can also influence the rate of secondary infection (Osborn et al 1985; Sisk et al, 1986).

The overall results of the present study corresponded well with those previously reported by Sisk et al, 1986; Christiaens and Reychler, (2002) with respect to infection and other complications.

In their study in 1987, Mitchell and Morris reported late infections in third molar surgery i.e. 4-6 weeks after the surgery. Other studies showed same delayed-onset infection rates such as Goldgerg et al (1.8%), Piecuch et al (1.8%) and Figueiredo et al (1.5%).

In the present study, three sockets in two patients presented with delayed onset infection after 3 weeks. One patient was on placebo medication and the other

patient presented infection on both the occasions (on first surgical visit with 1 gm of antibiotics and then 500 mg 8 hrly for two days and on second surgical visit on placebo capsules). The overall delayed-onset infection rate (0.78%) in the presented study correlates with the literature as discussed earlier.

Dry socket is one of the most common complications associated with third molar surgery. The overall rates of alveolar osteitis vary in the literature from 1% to 30%. The variability of reported percentages can be attributed largely to ambiguous diagnostic criteria (Susarla et al, 2003). Mandibular third molar surgery is more commonly associated with alveolar osteitis than maxillary third molar surgery.

Numerous studies supported that increasing age, female gender, oral contraceptives, smoking, surgical trauma and pericoronitis as risk factors for alveolar osteitis, although a significant number of studies also refuted these associations (Alexander, 2000). Sekhar (2001) and Bergdahl (2004) in their prospective studies compared systemic peri-operative use of metronidazole with placebo and found that the incidence of alveolar osteitis and early post-operative infection to be the same in both groups. Reekie et al (2006) in his double blind study, found no significant difference between the metronidazole and placebo groups.

Sanchis et al (2004) used tetracycline compound to prevent dry socket and concluded that intra-alveolar placement of tetracycline compound after the removal of impacted mandibular third molars did not affect the incidence of dry socket. Nordenram (1973) found that intra-alveolar tetracycline/neomycine-bactracin cones significantly reduce pain and alveolar osteitis (Nordenram, 1973).

In the present study only one patient developed alveolar osteitis (0.52%) after mandibular third molar removal. The patient was a 24 year old medical student. He had a disto-angular impaction which was removed without any complications. On further investigation, he mentioned that he used an excessive mouth rinse on the day of surgery.

Swelling is an expected sequela of the 3rd molar surgery. It reaches a maximum level 2 to 3 days post-operatively and normally subsides by the 4th day. It should completely resolve by the 7th day post-operatively. The use of cryotherapy or cold therapy is still controversial. Laureano et al (2005) supported the cryotherapy and found it effective in reducing swelling and pain. The study was done only on 114 patients, but results were statistically not significant.

Van der Westhuijzen and Morkel (2005) evaluated 60 patients in their randomized observer blind comparison of facial ice pack therapy with no ice therapy following third molar surgery. They found no statistically significant difference between the two treatment groups with respect to pain, facial swelling and trismus.

In a recent study (Master's mini thesis) at the same institution, the use of chewing gum therapy to reduce swelling after third molar surgery was researched. No significant difference between the chewing gum user and non user was found.

In the present study, we compare swelling in the two treatment groups. In the case of groups I and group II, the results indicate that there is a significant time effect ($p < 0.001$). This means that the swelling score changes over time. The results also indicate that there is a significant time treatment group interaction ($p < 0.05$). However, there is no significant evidence of treatment group effect ($p > 0.05$). Thus, the swelling score in the two treatment groups are not significantly

different as shown in the tables. These results are similar to those of Curran et al, (1974), Monaco et al, (1999) and those of Lloyd (1994).

Pain after third molar surgery usually begins when the effect of anesthesia subsides. It reaches its peak at 6 to 12 hours post-operatively. The effective manage pain management is regarded as an essential skill of the prudent surgeon. Preoperative systemic analgesics reduce pain by inhibition of central and peripheral pain receptors. Prophylactic analgesic therapy is intended to inhibit the effects of the surgery on the surrounding tissue.

The first drug to consider for pain is paracetamol (acetaminophen). It is indicated for the management of mild to moderate pain. Its favorable risk/benefit balance makes it a popular choice for acute postoperative dental pain.

Bjørnsson et al (2003) in his randomized, double blind, controlled, cross over study of 36 patients, concluded that a three days regimen of ibuprofen (600 mg 6 hourly) does not offer any clinical advantages compared with a traditional paracetamol regimen of 1000 mg, 6 hourly, for acute postoperative swelling and pain after third molar surgery. But the low number of patients used for the study, did not produce statistically significant results.

Paracetomol in combination with an opiate is an extremely effective analgesic (Comfrot et al, 2002 and Hargreaves, 2005). Non steroidal anti-inflammatory drugs (NSAIDS) are proven potent anti-inflammatory/analgesic drugs for acute pain (Haglund, 2006) and are widely used for third molar surgery.

Most painful problems that require analgesics will be due to inflammation. Pain management drugs include non-narcotic analgesics (e.g., non-steroidal anti-inflammatory drugs, paracetamol) or opiates (i.e., narcotics). Non-steroidal anti-inflammatory drugs (NSAIDs) provide excellent pain relief due to their anti-

inflammatory and analgesic action. The most common NSAIDs are asprin and ibuprofen. Paracetamol gives very effective analgesia but has little anti-inflammatory action. The opiates are powerful analgesics but have significant side effects. They are used in combination with paracetamol (Comfort et al, 2002; Hyllested et al, 2002).

In this study we used combination of analgesics and NSAIDS (i.e. ibuprofen, paracetamol and codine). We planned to give tilidine HCl as the escape oral opiate analgesic, but it was never needed.

The results shows that there were time effect (p-value<0.001) and pain changes over time. No statistically significant difference was found between the two treatment groups (p-value >0.05) after applying repeated measure analysis of variance as shown in the graph. These results correlate with those of Curran and Sekhar who also found no statistical significant difference between the antibiotic group and placebo to prevent infection after third molar surgery.

Trismus is often the result of surgical trauma. It is secondary to masticatory muscle and facial inflammation. Trismus is the body's attempt to prevent additional trauma or pain after third molar surgery (Rowe, 1982). Recognized regimens for treating trismus include ultrasonic therapy, pharmaco-therapeutics and cryotherapy.

In this study we found no statistical significant between the two treatment groups regard trismus (p-value >0.001). But there is significant differences between the class of impaction (p-value <0.05) i.e. in class III the patients suffered more trismus than those with class I and I. There is significant difference between low level impaction (depth C) and high level impaction (depth A) for trismus as shown in the graphs below.

Injuries to the inferior alveolar and lingual nerve are well recognized complications of third molar surgery. Sisk et al, (1986) mentioned the prevalence of damage to lingual and inferior alveolar nerve after third molar surgery to be from 0.04% to 22% (Sisk et al, 1986). In the majority of the review cases, paresthesia was found to be temporary and tends to subside within the first six months (Osborn et al, 1985).

The incidence of neurologic injuries from third molar surgery is related to multiple factors, including surgeon experience and proximity of the tooth relative to the inferior alveolar canal. Horizontally impacted teeth are generally more difficult to remove because of the increased need for bone removal and soft tissue manipulation when compared with distoangular or mesioangular impactions with higher incidence of nerve damage (Mostapha et al, 2001; Brann et al, 1999).

In the current study, only two patients, one from each group presented with neuropraxias (Seddon first degree injury). In group I, a 30 years old female with mandibular distoangular impaction showed signs of temporary dysesthesia. These symptoms subsided within two weeks. In group II, the patient had mandibular horizontal impaction, he also showed temporary dysesthesia, but the recovery was rapid and he took only four days to recover.

In this study, overall temporary nerve damage rates were 0.52%, which correlates the literature (Goldberg et al, 1985; Gülicher and Gerlach, 2001; Renton, 2001).

CHAPTER 7

LIMITATIONS OF THE STUDY

It was difficult to get the patients compliance because of the number of follow up visits as every patient has to come for follow up 8 times including the day of surgery. Five patients were unable to complete the follow up visits because of their domestic/financial conditions or other engagements.

CHAPTER 8

CONCLUSIONS AND RECOMMENDATIONS

The results of the study showed that the prophylactic antibiotics do not have statistically significant effects on post-operative infections. Therefore, there is no justification for using antibiotics routinely for third molar surgery. However, we need a safe and effective analgesic and anti-inflammatory combination after third molar surgery to prevent post-operative pain.

From the results of our study we believe that single dose pre-operative prophylaxis is a safe way to minimize the infection rate and costs in the hospital setting.

Complications invariably occur following the surgical removal of third molars. Attention to the basic principles of surgery, including proper preparation of the patient, asepsis, hemostasis, use of controlled force, thorough debridement, and meticulous management of both bone and soft tissues can reduce the number and severity of complications.

It is important to emphasize that surgical antibiotic prophylaxis is an adjunct to, not a substitute for good surgical technique and efforts to control overuse of antibiotics should be pursued.

References

Ashoo K, Powers MP. Anesthesia/ dentoalveolar surgery/office management. In: Fonseca RJ, editor. Oral and Maxillofacial Surgery. Philadelphia: WB Saunders; 2000. p. 258.

Bagheri SC, Khan HA. Extraction versus Nonextraction management of Third Molars. Oral Maxillofacial Surg Clin N Am 2007; 19: 15–21.

Barclay JK. Metronidazole and dry socket: Prophylactic use in mandibular third molar removal complicated by non acute pericoronitis. N Z Dent Jnl 1987; 83: 71.

Begg PR. Stone Man's Dentition. Am Jnl Ortho. 1954; 40: 298- 312.

Bishara SA & Andreasen G. Third Molars: A review. Am Jnl Ortho. 1983; 83,131-137.

Bjork A, Jensen E, Palling M. Mandibular growth and third molar impaction. Acta Odontol. Scand. 1956; 14: 231-72.

Bjørnsson GA, Haanaes HR, Skoglund LA. A randomized, double blind crossover trial of paracetamol 1000 mg four times daily vs ibuprofen 600 mg: effect on swelling and other postoperative events after third molar surgery. British J Clin Pharmacol 2003; 55: 405-412.

Bruce RA, Fredrickson GC, Small GS. Age of patient and morbidity associated with mandibular third molar surgery. J Am Dent Assoc 1980; 101:240-5.

Burke JF. Preventing bacterial infection by coordinating antibiotic and host activity: a time dependent relationship. South Med J 1977; 70(S1):24–6.

Burke JF. The effective period of preventive antibiotic action in experimental incisions and dermal lesions. Surgery 1961; 50:161-168.

Bystedt H, Nord CE, Nordenram A. Effect of azidocillin, erythromycine, clindamycine and doxycycline on post-operative complications after surgical removal of impacted mandibular third molars. Int J Oral Surg 1980; 9; 3:157-165.

Capuzzi P, Montebugnoli L, Vaccaro MA. Extraction of impacted third molars: A longitudinal prospective Study. Oral Surgery 1994; 77:341.

Classen DC, Evans RS, Pestonik SL, Horn SD, Menlove RL, Burke JP. The timing of prophylactic administration of antibiotics and the risk of surgical-wound infection. N Eng J Med 1992; 326: 281-286.

Comfort MB, Tse AS, Tsang AC, MCGrath C. A study of the comparative efficacy of three common analgesics in the control of pain after third molar surgery under local anaesthesia. Aust Dent J 2002; 47:327-330.

Curran JB, Kenneth S, Young AR. An assessment of the use of prophylactic antibiotics in third molar surgery. Int J Oral Surg 1974; 3:1-6.

Dajni AS, Taubert KA, Wilson W, Bolger AF, Bayer A, et al. Prevention of Bacterial Endocarditis (Recommendations by the American Heart Association). J Am Med Assoc. 1997;277:1794-1801.

Diniz-Freitas M, Lago-Mendez L, Gude-Sampedro F, et al. Pedersen scale fails to predict how difficult it will be to extract lower third molars. Br J Oral Maxillofac Surg 2007; 45:23-26.

Erasmus F. The Removal of Third Molars. SADJ. 2002; 57(10): 339-403.

Farish ES, Bouloux FG. General technique of third molar removal. Oral Maxillofac Surg Clin N Am 2007; 19:23-43.

Farman AG. Tooth Eruption and Dental Impaction: Panoramic imaging news 2004; 2:1-9.

Flynn TR, Halpern LR. Antibiotic selection in head and neck infections. Oral Maxillofac Surg Clin N Am 2003; 15: 17-38.

Fuselier JC, Ellis EE, Dabson TB. Do Mandibular Third Molars Alter the Risk of Angle Fracture? J. Oral Maxillofac Surg 2002; 60: 514-518.

Gold HS, Moellering RC. Antimicrobial drug resistance. N Eng J Med 1996; 335: 1445-1453.

Goldberg MH, Nemarich AN, Marco WP. Complications after mandibular third molar surgery: a statistical analysis of 500 consecutive procedures in private practice. J Am Dent Asso 1985; 111:277-279

Gregor M AJ. Anti-prophylactic antibiotics. J Oral Surg 1976; 34: 1063.

Gülicher D, Gelach KL. Sensory impairment of inferior alveolar nerves following removal of impacted mandibular third molars. Int. J. Oral Maxillofac Surgery 2001; 30: 306-312.

Happonen RP, Backstrom AC, Ylipaavalniemi P. Prophylactic use of phenoxymethyl penicillin and tinidazole in mandibular third molar surgery, a comparative placebo controlled clinical trial. Br J Oral Maxillofac Surg 1990; 28:12-15.

Hargreaves K. Drugs for pain management in dentistry. Aus Dent Journal 2005; 50 (Suppl2): S14-S22.

Hendrix W & Tall, J. Reasons for removing third molars LA County USC Med Center. Presented Southern California Dent Assoc. May 1971. (Quoted in Goodsell JF 1977).

Hyllested M, Jones S, Pedersen JL, Kehlet H. Comparative effect of paracetamol, NSAIDs or their combination in post-operative pain management: a qualitative review. Br J Anaesth 2002; 26:2003-2014.

Iida S, Nomura K, Okura M, et al. Influence of the incompletely erupted lower third molar on mandibular angle and condylar fractures. J Trauma 2004; 57: 613–7.

Jobe BA, Grasley A, Deveney KE, Deveney CW, Sheppard BC. Clostridium difficile colitis: an increasing hospital acquired illness. Am J Surg 1995; 169: 480-483.

Koerner KR. The Removal of the Impacted Third molars. Dent Clin N Am 1994; 38(2): 255-278.

Krekmanov L, Hallander HO. Relationship between bacterial contamination and alveolitis after third molar surgery. Int J Oral Surg 1980; 9:274-280.

Laskin DM. The use of prophylactic antibiotics for the prevention of postoperative infections. Oral Maxillofac Surg Clin N Am 2003; 15: 155-160.

Laskin DM. Prophylactic antibiotics: A problem or panacea? J Oral Surg 1976; 34:585.

Lawler B, Sambrook PJ. Antibiotic prophylaxis for dentoalveolar surgery: is it indicated, Aust Dent J Med 2005; 50 (Suppl 2): s54-s59.

Lieblich SE: Postoperative prophylactic antibiotic treatment in third molar surgery-A necessity? J Oral Maxillofac Surg 2004; 62:9.

Lindquist B, Extraction of third molars in cases of anticipated crowding of the lower jaw. Am Jnl Orthod 1982; 81:130-139.

Lloyd CJ, Earl PD. Metronidozole: two or three tomes daily- a comparative controlled clinical trial of the efficacy of two different dosing schedules of metronidazole for chemoprophylaxis following third molar surgery. Brt J Oral Maxillofac Surgery 1995; 32:165-167.

Lytle JJ. Etiology and Indications for the Management of Impacted Teeth. Oral and Maxillofac Surg Clin N Am 1993; 5(1): 63-75.

MacGregor AJ, Addy A. Value of penicillin in the prevention of pain, swelling and trismus following the removal of mandibular third molars. Int J Oral Surg 1980; 9:166-171.

Mangram AJ, Horan TC, Pearson ML, Christine Silver L, Jarvis WR. Guidelines for prevention of surgical site infection. Am J Infect Cont 1999; 27: 97-132.

Marciani RD. Third molar removal: an overview of indications, imaging, evaluation, and assessment of risk. Oral Maxillofac Surg Clin N Am 2007; 19: 1–13.

Martin C. Antimicrobial prophylaxis in surgery: general concepts and clinical guidelines. French Study Group on Antimicrobial prophylaxis in surgery, French Society of Anesthesia and intensive care. Infec Cont Hosp Epide 1994; 15: 463-471.

Martin MV, Kanatas N, Hardy P. Antibiotic prophylaxis and third molar surgery. Brt Dent Jnl 2005: 198:327-330.

Mattes TG, Nienhuijs ME, van der Sanden WJ, et al. Interventions for treating asymptomatic impacted wisdom teeth in adolescents and adults. Cochrane Database Syst Rev 2005; 18(2): CD003879.

McCaig LF, Hughes JM. Trends in antimicrobial drug prescribing among office-based physicians in the United States. J Am Med Asso 1995; 273: 214-9.

Mercier P and Precious D. Risks and Benefits of Removal of Impacted Third Molars. A Critical Review of the Literature. J. Oral Maxillofac.Surg 1992; 21:17-27.

Mettes TG, Nienhuijs MEL, Van der Sanden WJM, Verdonscot EH. Interventions for treating asymptomatic impacted wisdom teeth in adolescents and adults. Aust Dent Jnl 2005; 50(3):207-208.

Mitchell DA. A controlled clinical trial of prophylactic tinidazole for chemoprophylaxis in third molar surgery. Brt Dent Jnl 1986; 160; 86:284-287.

Mitchell DA, Morris TA. Tinidazole or pivampicillin in third molar surgery. Int J Oral Maxillofac Surg 1987; 16:171-174.

Monaco G, Staffolani C, Gatto MR, Checchi L. Antibiotic therapy in impacted third molar surgery. Eur J Oral Sci 1999: 107: 437-441.

Mostafa P, Hill CM, Thomas DW, Newcombe RG, Walker RV. Nerve morbidity following wisdom tooth removal under local and general anaesthsia. Brt Jnl of Maxillofac Oral Surg 2001; 39: 419-422.

Namias N, Harvill S, Ball S, McKenney MG, Salomone JP, Civetta JM. Cost and morbidity associated with antibiotic prophylaxis in the ICU. J Am Coll Surg 1999; 188: 225-230.

National Institute for Clinical Excellence. Guidance on the extraction of wisdom teeth. Available at: http:// www.nice.org.uk/pdf/wisdomteethguidance.pdf. Accessed March 9, 2006.

New HC. Prophylaxis–has it at last come of age? J Antimicrob Chemother 1979; 5(4):331–3.

NIH Consensus Development Conference for Removal of Third Molars. J Oral Surg 1980; 38: 235-236.

Nordenram A, Sydnes G, Odegaard J: Neomycin-bacitracin cones in impacted third molar sockets. Int J Oral Surg 1973; 2:279-283.

Osborn TP, Frederickson GJR, Small IA, Torgerson AT. A prospective study of complications related to Mandibular Third Molar Surgery. J Oral Maxillofac Surg 1985; 43: 767-769.

Pallasch TJ. A critical appraisal of antibiotic prophylaxis. Int Dent J 1989; 39: 183-196.

Paluzzi RG. Antibiotic prophylaxis for surgery. Med Clin N Am 1993; 77: 427–441.

Peck S, Peck L, Kataja M. Concomitant Occurrence of Canine malposition and Tooth Agenesis: Evidence of Orofacial Genetic Fields. Am. J Orthod Dentofacial Orthop. 2002; 122: 657-60.

Pedersen G. Surgical removal of teeth. In: Surgical removal of teeth. Philadelphia: Pedersen; 1988. p. 63.

Pell G, Gregory B. Impacted third molars: classification and modified techniques for removal. Dent Dig 1933; 39:330-337.

Pell GJ, Gregory GT. Report on a ten-year study of a tooth division technique for the removal of impacted teeth. Am J Orthod 1942; 28:660-666.

Peterson L J. Principles of Management of Impacted Teeth in: Peterson L.J, Ellis III E, Hupp J.R, Tuker M.R, (Eds). Contemporary Oral & Maxillo- Facial Surgery 3rd Edition. St. Louis: Mosby; 1998. Page: 215-48.

Peterson LJ. Antibiotic prophylaxis against wound infection in oral and maxillofacial surgery. American Association of Oral and Maxillofacial Surgeons 1990; 48: 617-620.

Piecuch JF, Arzadon J, Lieblich SE. Prophylactic antibiotics for third molar surgery: A supporting opinion. J Oral Maxillofac Surg 1995; 53:53.

Poeschl WP, Eckel D, Poeschl E. Postoperative prophylactic antibiotic treatment in third molar surgery- A necessity? J Oral Maxillofac Surg 2004; 62:3-8.

Pogrel AM. Infection management. Oral and Maxillofacial Clinics of N Am 1993; 5:127- 135.

Polk JR, Lopez-Mayor JR. Post-operative wound infection: a prospective study of determinant factors and prevention. Surgery 1969; 66:97–103.

Privitera G, Scarpellini P, Ortisi G, Nicastro G, Nicolin R, de Lalla F. Prospective study of Clostridium difficile intestinal colonisation and disease following single dose antibiotic prophylaxis in surgery. Antimicrob Agents Chemother 1991; 35: 208-210.

Reekie D, Downes P, Devlin CV, Nixon GM, Devlin H. The prevention of 'dry socket' with topical metronidazole in general dental practice. British Dental Journal 2006; 200(4): 210-213.

Renton T, McGurk M. Evaluation of factors predictive of lingual nerve injury in third molar surgery. British Journal of Oral and Maxillofacial Surgery 2001; 39: 423-428.

Richardson M. Late third molar genesis. Its significance in orthodontic treatment. Angle Orthod 1980. 50:121-128.

Richardson M. The Etiology and Prediction of Mandibular Third Molar Impaction. Angle Orthod. 1977; 47: 165-72.

Sekhar CH, Narayanan M, Baig F. Role of antimicrobials in third molars in third molar surgery: prospective, double blind, randomized, placebo-controlled clinical study. Br J Oral Maxillofac Surg 2001; 39: 134-137.

Sisk AL, Hammer WB, Shelton DW, Joy ED. Complications following removal of third molar impacted teeth. Jnl Oral Maxillofac Surg 1986; 44: 855-859.

Song F, Landes DP, Glenny AM, Sheldon TA. Prophylactic Removal of Impacted Third Molars: An Assessment of Published reviews. Health Technol. Assess. 2000; 4(15): 1-55.

Song F, Landes DP, Glenny AM, Sheldon TA. The prophylactic removal of impacted third molars: an assessment of published reviews, Br Dent Jnl 1997; 182:339-346.

Stephens RG, Kogon SL , Reid JA. The unerupted or impacted third molar a critical appriasal of its pathologic potential. J of Can Dent Asso 1989; 55: 201-207.

Stone HH, Haney BB, Kolb LD, Geheber CE, Hooper CA. Prophylactic and preventive antibiotic therapy: timing, duration and economics. Ann Surg 1979; 189(6): 691–699.

Stone HH, Hooper CA, Kolb LD. Antibiotic prophylaxis in gastric, biliary and colonic surgery. Ann Surg 1976; 184: 443.

Stone HH. Basic principles in the use of prophylactic antibiotics. J Antimicrob Chemother 1984; 14(SB):33–37.

Susarla SM, Blaeser BF, Magalnick D. Third molar surgery and associated complications. Oral Maxillofac Surg Clin N Am 2003; 15: 177-186.

Van der Linden WJ, Lownie JF and Cleaton-Jones PE, Should impacted third molars be removed? A review of the literature. Jnl of the Dent Asso South Afric 1993; 48: 235-240.

Van der Westhuijzen AJ, Morkel JA, Becker PJ, Roelse JA. A randomized observer blind comparison of bilateral facial ice pack therapy with no ice therapy following third molar surgery. Int. J. Oral Maxillofac. Surgery 2005; 43: 281-286.

Winter G. Impacted mandibular third molar. St.Louis (MO): American Medical Book Co.; 1926.

Yamaoka M. Tambo A. Furusawa K. Incidence of Inflammation in Completely Impacted Lower Third Molars. Aus. Dent. J. 1997; 42:153-155.

Young SEJ. Aetiology and epidemiology of infective endocarditis in England and Wales. J Antimicrob Chemotherap 1987; 20 (Suppl A): 7-14.

Zeitler DL. Prophylactic antibiotics for third molar surgery: A dissenting opinion. Journal of Oral Maxillofac Surg 1995; 53:61.

Zhu SJ, Chi BH, Kim HJ. Relationship between the presence of unerupted mandibular third molars and fractures of the mandibular condyle. Int J Oral Maxillofac Surg 2005; 34:382–385.

Appendix

Appendix-1

Department of Maxillo-Facial and Oral Surgery
Faculty of Dentistry& WHO Oral Health Collaborating Centre

University of the Western Cape

Cape Town

April**,** 2006. (Appendix-1)

<u>Patient Information Letter</u>

Currently most doctors gave antibiotics before and after tooth removal (extraction), to prevent infection before it occurs. We all know, antibiotics can be harmful to the body. There is not much literature to support antibiotic usage before and after tooth removal.

The department of Maxillo-facial and Oral Surgery (University of the Western Cape) Oral Health Centre and the Medical Research Council (MRC) is conducting a study (experiment / research) on the use of antibiotics to prevent infection in third molar surgery.

The aim of the research is to determine whether it is useful to give antibiotics after tooth removal (third molar surgery) or not .All patients taking part in the study will benefit from the treatment.

Two wisdom teeth will be removed under antibiotic cover and two will be removed without antibiotic cover. Neither patient nor surgeon will know which teeth were removed under antibiotic cover. It will therefore be possible to determine whether antibiotics are useful or not.

After the surgical procedure patients will receive tablets/ capsules. The exact nature of the medication will not be revealed (The capsule will be of same shape and size but will have active content (Antibiotic) or just glucose in it). Willing participants in this study will be required to sign a consent form.

As a large number of patients are required for this study, it would be appreciated if participants enrolling for the study see it through to completion.

Thanking you in anticipation.

Prof J.A.Morkel   **Dr A. Siddiqi**

Department of Maxillofacial & Oral Surgery.   Researcher

Oral Health Centre Tygerberg.

Appendix-2

Consent form

Department of Maxillo-Facial and Oral Surgery

Faculty of Dentistry& WHO Oral Health Collaborating Centre

University of the Western Cape

Cape Town

I Mr/Miss/Mrs._____Date of birth_____File no: _____ am willing to participate in the above mentioned study. I understand that the study is voluntary. I have been informed of the procedure and of the possible complications which can occur during and after the procedure.

I agree to the administration of local anaesthesia and other measures as discussed that may be necessary for my comfort, safety, and well being.

I realize that occasionally there are complications with this surgery and the medications. The more common complications include pain; swelling; bleeding; difficulty in mouth opening; discoloration of the skin; infection; dry socket and temporary numbness and / or tingling of the lip, chin, gums, cheek, teeth or tongue.

In some cases, even with the utmost care there can be stiffness of the neck and facial muscles; changes in the bite and temporomandibular joint; nausea; allergic reactions; bone fractures; injury to the adjacent teeth and delayed healing of the wound.

I know that some of the above-mentioned complications can be avoided or reduced by carefully following the doctor's instructions. I have had the opportunity to ask questions about the procedure and aspects related to the Study (experiment/ research) and have had them answered to my satisfaction.

This study is approved by the Ethical and Research Committee of the University of the Western Cape and participation in this study is on voluntary basis. I am being adequately informed about the objective of the trial. I also know that I have the right to withdraw from the study at any stage which will not prejudice me in way regarding future treatments. My rights will be protected, and all my details will be kept confidential, and no details regarding me, personally will be published.

I hereby consent to the surgery.

 Patient's name: _____   Signature: _____

 Name of the Witness: _____   Signature: _____

 Signature of the Researcher._____

Dr.Siddiqi

Appendix-3

Data capture sheet (Pre-op)

File no _____ **Case no:** _____

Sex. M / F Group**:** _____

Date of birth: D/ M/ Y/ Date of operation**:** _____

Address/phone_____

_____

Teeth to be extracted. _____

Type of Impaction

Classification Systems	Mandibular	Maxillary
Winter's classification Vertical / Horizontal / Distoangular / Mesioangular.		
Pell and Gregory Ramus classification Class-I / Class-II / Class-III.		
Pell and Gregory occlusal classification Level -1/ Level-2 / Lev el-3		

Inter-incisal mouth opening (mm)
Preoperatively _____
Swelling
Preoperatively _____
Pain (VAS)
Preoperatively _____
Patient will record pain at home for the rest of time (from day 1 to day-14)
Maximum mouth opening (mm)
Preoperatively _____
Temperature: (> 38 ° C)
Preoperatively _____
Infection/ clinical collection of pus
Preoperatively _____
Adverse reactions to antibiotics (previous experience)
GI irritation (diarrhea, vomiting, and nausea) _____
 Skin reactions, fungal infections, Anaphylaxis

_____
Date_____ **Dr A. Siddiqi**

Appendix-4

Data capture sheet (Day-3, 7 & 14)

File no _____   **Case no:** _____

Group**:** _____

Teeth extracted _____

Inter-incisal mouth opening (mm)

On the third day of surgery   _____

Swelling

On the third day   _____

Pain (VAS)

On the third day   _____

Patient will record pain at home for the rest of time (from day 1 to day-14)

Maximum mouth opening (mm)

On the third day   _____

Temperature: (> 38 ° C)

On the third day   _____

Infection/ clinical collection of pus

 On the third day   _____

Dry socket

 On the third day   _____

Adverse reactions to antibiotics

GI irritation (diarrhea, vomiting, and nausea),   _____

 Skin reactions, fungal infections, Anaphylaxis

                                                                        _____

Date _____   **Dr A. Siddiqi**

Apendix-5

Visual Analogue Scale/ Graphic Rating Scale

File no._____   **Teeth extracted**_____   **Group**_____
Date _____

Day of Surgery

        Afternoon   *Evening*

I do not have any pain   My pain could not be worse   I do not have any pain   My pain could not be worse

mild pain   moderate pain   severe pain   mild pain   moderate pain   severe pain

Day -1   *Morning*   *Afternoon*
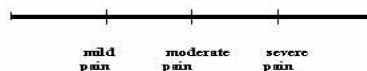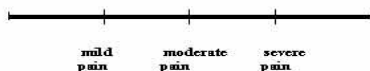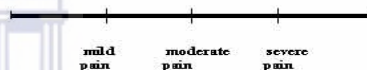
I do not have any pain   My pain could not be worse   I do not have any pain   My pain could not be worse

mild pain   moderate pain   severe pain   mild pain   moderate pain   severe pain

                   Evening

I do not have any pain   My pain could not be worse

mild pain   moderate pain   severe pain

Day - 2   *Morning*   *Afternoon*

I do not have any pain   My pain could not be worse   I do not have any pain   My pain could not be worse

mild pain   moderate pain   severe pain   mild pain   moderate pain   severe pain

                   Evening

I do not have any pain   My pain could not be worse

mild pain   moderate pain   severe pain

Day -3   *Morning*   *Afternoon*
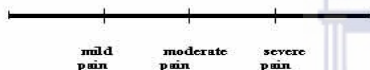
I do not have any pain   My pain could not be worse   I do not have any pain   My pain could not be worse
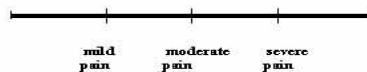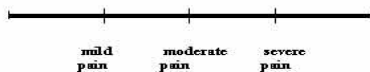
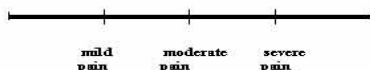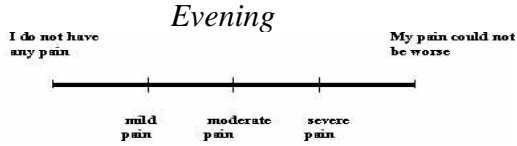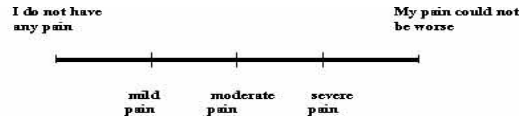mild pain   moderate pain   severe pain   mild pain   moderate pain   severe pain

Evening

I do not have any pain ———————|———————|———————|——————— My pain could not be worse

mild pain   moderate pain   severe pain

Day -4   *Morning*   *Afternoon*

I do not have any pain ———————|———————|———————|——————— My pain could not be worse   I do not have any pain ———————|———————|———————|——————— My pain could not be worse

mild pain moderate pain severe pain   mild pain moderate pain severe pain

Evening

I do not have any pain ———————|———————|———————|——————— My pain could not be worse

mild pain moderate pain severe pain

Day -5   *Morning*   *Afternoon*

I do not have any pain ———————|———————|———————|——————— My pain could not be worse   I do not have any pain ———————|———————|———————|——————— My pain could not be worse

mild pain moderate pain severe pain   mild pain moderate pain severe pain

Evening

I do not have any pain ———————|———————|———————|——————— My pain could not be worse

mild pain moderate pain severe pain

Day -6   *Morning*   *Afternoon*

I do not have any pain ———————|———————|———————|——————— My pain could not be worse   I do not have any pain ———————|———————|———————|——————— My pain could not be worse

mild pain moderate pain severe pain   mild pain moderate pain severe pain

Evening

I do not have any pain ———————|———————|———————|——————— My pain could not be worse

mild pain moderate pain severe pain

Day -7   *Morning*   *Afternoon*

I do not have any pain ———————|———————|———————|——————— My pain could not be worse   I do not have any pain ———————|———————|———————|——————— My pain could not be worse

mild pain moderate pain severe pain   mild pain moderate pain severe pain

Evening

I do not have any pain _____ My pain could not be worse

mild pain   moderate pain   severe pain

Day -8

Morning

I do not have any pain _____ My pain could not be worse

mild pain   moderate pain   severe pain

Afternoon

I do not have any pain _____ My pain could not be worse

mild pain   moderate pain   severe pain

Evening

I do not have any pain _____ My pain could not be worse

mild pain   moderate pain   severe pain

Day -9

Morning

I do not have any pain _____ My pain could not be worse

mild pain   moderate pain   severe pain

Afternoon

I do not have any pain _____ My pain could not be worse

mild pain   moderate pain   severe pain

Evening

I do not have any pain _____ My pain could not be worse

mild pain   moderate pain   severe pain

Day -10

Morning

I do not have any pain _____ My pain could not be worse

mild pain   moderate pain   severe pain

Afternoon

I do not have any pain _____ My pain could not be worse

mild pain   moderate pain   severe pain

Evening

I do not have any pain _____ My pain could not be worse

mild pain   moderate pain   severe pain

Day -11

Morning

I do not have any pain | mild pain | moderate pain | severe pain | My pain could not be worse

Afternoon

I do not have any pain | mild pain | moderate pain | severe pain | My pain could not be worse

Evening

I do not have any pain | mild pain | moderate pain | severe pain | My pain could not be worse

Day -12

Morning

I do not have any pain | mild pain | moderate pain | severe pain | My pain could not be worse

Afternoon

I do not have any pain | mild pain | moderate pain | severe pain | My pain could not be worse

Evening

I do not have any pain | mild pain | moderate pain | severe pain | My pain could not be worse

Day -13

Morning

I do not have any pain | mild pain | moderate pain | severe pain | My pain could not be worse

Afternoon

I do not have any pain | mild pain | moderate pain | severe pain | My pain could not be worse

Evening

I do not have any pain | mild pain | moderate pain | severe pain | My pain could not be worse

Day-14

Morning

I do not have any pain | mild pain | moderate pain | severe pain | My pain could not be worse

Afternoon

I do not have any pain | mild pain | moderate pain | severe pain | My pain could not be worse

Patients signature _____

Apendix-6

Key

Total score difference in, pain, swelling mouth opening (trismus), Dry socket, Clinical Collection of pus, Temperature.

Pain

Variables	_Score_
None	0
Mild	1
1	
Moderate	2
Severe	3
Could not be worse	4

Swelling

Variables	_Score_
None (absent)	0
Mild (just visible and palpable)	
Moderate (obvious)	2
Severe	3

Trismus (Difference in mouth opening in mm)

Variables	_Score_
None	0
1-5 mm	1
6-10 mm	2
11-15 mm	3
16-20 mm	4
>20 mm	5

Dry socket

Variables	_Score_
None	0
Yes	1

Clinical collection of pus

Variables	_Score_
None	0
Yes	1

Temperature (>38° C)

Variables	_Score_
No	0
Yes (>38° C)	1

Appendix (**Results**)

Table-I Treatment Groups Infection day 3 Cross-tabulation

| | | | Infection day 3 | | Total |
			No	Yes	
T_Group	One dose of 1gm only	Count	47	1	48
		% within T_Group	97.9%	2.1%	100.0%
	Placebo of group 1	Count	46	2	48
		% within T_Group	95.8%	4.2%	100.0%
	Two days of antibiotics	Count	46	1	47
		% within T_Group	97.9%	2.1%	100.0%
	Placebo of group 2	Count	46	1	47
		% within T_Group	97.9%	2.1%	100.0%
Total		Count	185	5	190
		% within T_Group	97.4%	2.6%	100.0%

Table I shows the occurrence of infection after 3 days of surgery in the treatment groups

Table -II Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.344(b)	1	.557		
Continuity Correction(a)	.000	1	1.000		
Likelihood Ratio	.351	1	.554		
Fisher's Exact Test				1.000	.500
Linear-by-Linear Association	.341	1	.560		
N of Valid Cases	96				

a Computed only for a 2x2 table
b 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.50.

Table - III Treatment Group I & II Infection day 3 Cross tabulations

			Infection day 3		Total
			No	Yes	
T_Group	One dose of 1gm only	Count	47	1	48
		% within T_Group	97.9%	2.1%	100.0%
	Two days of antibiotics	Count	46	1	47
		% within T_Group	97.9%	2.1%	100.0%
Total		Count	93	2	95
		% within T_Group	97.9%	2.1%	100.0%

Table III shows infection rates of two treatment groups after third day of surgery. Forty eight patients were operated in group I compared to 47 in group II.

Table - IV Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.000(b)	1	.988		
Continuity Correction(a)	.000	1	1.000		
Likelihood Ratio	.000	1	.988		
Fisher's Exact Test				1.000	.747
Linear-by-Linear Association	.000	1	.988		
N of Valid Cases	95				

a Computed only for a 2x2 table
b 2 cells (50.0%) have expected count less than 5. The minimum expected count is .99.

Table – V Treatment Group I & II Infection day 7 Cross tabulations

			Infection day 7		Total
			No	Yes	
T_Group	One dose of 1gm only	Count	48	0	48
		% within T_Group	100.0%	.0%	100.0%
	Two days of antibiotics	Count	46	1	47
		% within T_Group	97.9%	2.1%	100.0%
Total		Count	94	1	95

	% within T_Group	98.9%	1.1%	100.0%

Table V shows prevalence of infection in the two treatment groups after seven days of surgery. No infection was found in group I compared to one in group II.

Table – VI Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.032(b)	1	.310		
Continuity Correction(a)	.000	1	.992		
Likelihood Ratio	1.418	1	.234		
Fisher's Exact Test				.495	.495
Linear-by-Linear Association	1.021	1	.312		
N of Valid Cases	95				

a Computed only for a 2x2 table
b 2 cells (50.0%) have expected count less than 5. The minimum expected count is .49.

Table -VII Treatment Groups Infection Cross tabulation among the different treatment groups

			Infection_total	
			1.00	Total
T_Group	One dose of 1gm only	Count	1	1
		% within T_Group	100.0%	100.0%
	Placebo of group 1	Count	2	2
		% within T_Group	100.0%	100.0%
	Two days of antibiotics	Count	1	1
		% within T_Group	100.0%	100.0%
	Placebo of group 2	Count	1	1
		% within T_Group	100.0%	100.0%
Total		Count	5	5
		% within T_Group	100.0%	100.0%

Table shows occurrence of infection among the two treatment groups and placebo. Total five infections were found. Placebo of group I show higher numbers of infection compared to other treatment groups. These results are statistically not significant

Table -VII Multiple Comparisons Tukey HSD

(I) Type P&GRms mandible	(J) Type P&GRms mandible	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Class I	Class II	-.22	.137	.244	-.54	.10
	Class III	-1.53(*)	.500	.007	-2.71	-.34
Class II	Class I	.22	.137	.244	-.10	.54
	Class III	-1.31(*)	.492	.023	-2.47	-.14
Class III	Class I	1.53(*)	.500	.007	.34	2.71
	Class II	1.31(*)	.492	.023	.14	2.47

Based on observed means.
- **The mean difference is significant at the .05 level**

Table - 9 Test Within-Subjects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Time	Sphericity Assumed	12.112	2	6.056	30.416	.000
	Greenhouse-Geisser	12.112	1.594	7.597	30.416	.000
	Huynh-Feldt	12.112	1.635	7.408	30.416	.000
	Lower-bound	12.112	1.000	12.112	30.416	.000
time * T_Group	Sphericity Assumed	1.613	2	.807	4.052	.019
	Greenhouse-Geisser	1.613	1.594	1.012	4.052	.027
	Huynh-Feldt	1.613	1.635	.987	4.052	.026
	Lower-bound	1.613	1.000	1.613	4.052	.047
Error(time)	Sphericity Assumed	37.032	186	.199		
	Greenhouse-Geisser	37.032	148.262	.250		
	Huynh-Feldt	37.032	152.057	.244		
	Lower-bound	37.032	93.000	.398		

Table -10 Tests of Between-Subjects Effects Transformed Variable: Average

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Intercept	19.844	1	19.844	40.810	.000
T_Group	1.374	1	1.374	2.826	.096
Error	45.222	93	.486		

Table -XI Infection at third day after surgery

			Infection day 3		
			No	Yes	Total
T-Group	One dose of 1gm only	Count		1	48
		% within T-Group	97.9%	2.1%	100.0%
	Placebo of group 1	Count	46	2	48
		% within T-Group	95.8%	4.2%	100.0%
	Two days of antibiotics	Count	46	1	47
		% within T-Group	97.9%	2.1%	100.0%
	Placebo of group 2	Count	46	1	47
		% within T-Group	97.9%	2.1%	100.0%
Total		Count	185	5	190
		% within T-Group	97.4%	2.6%	100.0%

Table shows the prevalence of infection in two treatment groups after third day of surgery

Table –XII Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.000(b)	1	1.000		
Continuity Correction(a)	.000	1	1.000		
Likelihood Ratio	.000	1	1.000		
Fisher's Exact Test				1.000	.753
Linear-by-Linear Association	.000	1	1.000		
N of Valid Cases	94				

A- Computed only for a 2x2 table
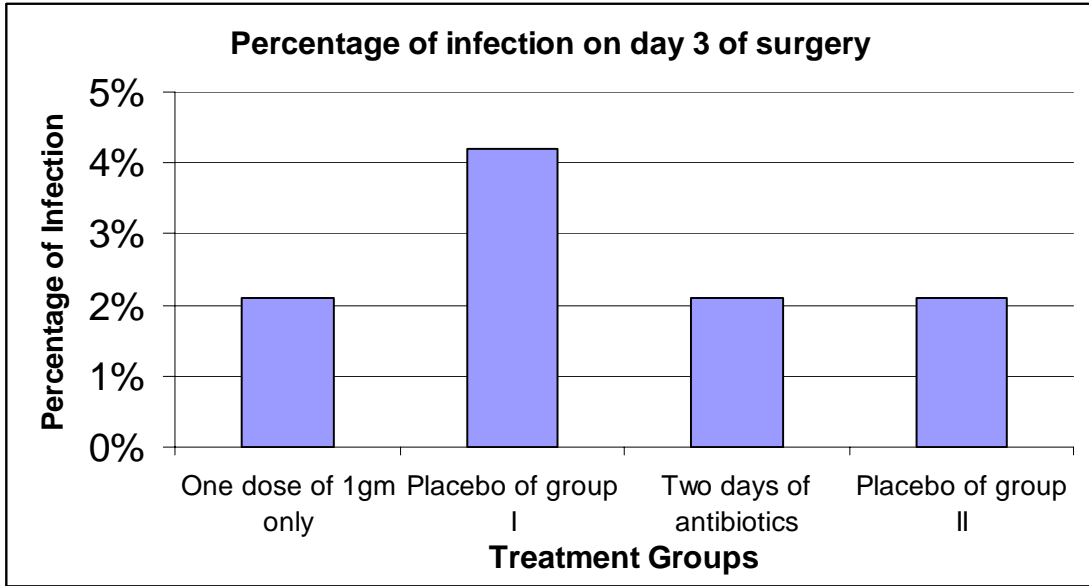**B- 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.00**

Figure-1 Percentage of infection on day 3

****