University of the Western Cape

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Comparison of a piezoelectric and a standard surgical handpiece in third molar surgery

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COMPARISON OF A PIEZOELECTRIC AND A STANDARD SURGICAL HANDPIECE IN THIRD MOLAR SURGERY

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A mini-thesis submitted in partial fulfillment of the requirements for the degree of Magister Chirurgiae Dentium in the Department of Maxillo-Facial and Oral Surgery at the University of the Western Cape

January 2010

DECLARATION

I declare that the study entitled "*Comparison of a piezoelectric and a surgical handpiece in third molar surgery"* is my own work, that this has not been submitted for any degree or examination at any other university, and that the sources I have used or quoted have been indicated and acknowledged by complete references.

Ismael Gopal   January 2010

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Abstract

Key words: Piezoelectric; surgical handpiece; impaction; third molar surgery.

Purpose: To compare the use of a piezoelectric with a standard surgical handpiece in third molar surgery.

Patients and methods: Thirty patients requiring removal of third molars were included in the study. Panoramic radiographs were used to assess the third molars. The patients were randomly subdivided and the split-mouth technique applied. In split-mouth design, divisions of the mouth, such as right (upper and lower) and left (upper and lower) quadrants constitute the experimental units, which are randomly assigned to two treatment groups. Each patient serves as his or her own control, which increases statistical efficiency (Siddiqi *et al.* 2010). Each side was operated with either a piezoelectric or a conventional handpiece. All aspects of preoperative care, general anaesthesia, surgery and postoperative care were standardized for the groups.

The duration of surgery was logged, in minutes, from the start of incision to the end of suturing. Bleeding during surgery was evaluated by means of a visual analogue scale. Pain was assessed twenty-four hours postoperatively by means of a visual analogue scale. The incidence of complications was also assessed twenty-four hours postoperatively by assessing trauma to the intra-oral soft tissue and lip at the end of surgery as well as the presence of any nerve injury.

Results: No statistically significant difference was found between the groups in terms of pain and swelling. Although surgical time was longer, less bleeding occurred with the use of the piezoelectric device compared to the standard surgical handpiece. There were no reports of trauma to the lips or intra-oral soft

tissue with the use of either of the devices. There were two incidences (6,7%) of postoperative paraesthesias in the standard surgical handpiece group.

Conclusion: The use of a piezoelectric device is an acceptable alternative to the standard surgical handpiece in third molar surgery.

Introduction

Third molar surgery is the most common procedure performed in oral and maxillofacial surgery practice (Tetsch and Wagner 1982). Some of the most frequent complaints following third molar surgery, according to the work of Oikarinen in 1991 and Kim in 2006, are pain and trismus. Fisher in 1988 showed that trismus and swelling are closely associated with acute inflammation following third molar surgery. Inferior alveolar nerve injury is a well documented complication of maxillofacial procedures such as third molar surgery (Genu *et al* 2008). Susarla and Dodson (2007) stated that the incidence of nerve damage ranges from 1% to 22% and has become a common cause of litigation. Several therapeutic protocols have thus been evaluated to support improvements in the postoperative period.

Piezoelectric surgery techniques have opened up a new age for osteotomy, osteoplasty and exodontia in maxillofacial and oral surgery. As well as being selective, the micrometric cuts possible via these techniques maximize surgical precision, resulting in minimal damage to soft tissue. In addition, the cavitation effect provides maximum intraoperative visibility and a blood-free surgical site.

It was thus decided to compare the use of a piezoelectric (Surgybone®) device with the standard surgical handpiece in third molar surgery in an analytical prospective case series of selected patients attending the Maxillo-Facial and Oral surgery outpatient clinic at the Faculty of Dentistry and World Health Organization (WHO) Collaboration Centre of the University of the Western Cape (UWC).

Literature Review

Third molars are, directly or indirectly, the underlying cause of numerous disorders in the mouth, jaw and facial regions. According to Sortino *et al.* (2008), impacted or semi-impacted third molars in the mandible may have several consequences. These include pericoronitis, regional pain, abscess, trismus, distal caries, periodontal pocket of the second molar, development of follicular cysts and crowding of lower incisors (Punwutikorn *et al.*1999). As a result, their removal is often necessary, and their surgical removal the most frequently undertaken oral surgical procedure (Tetsch and Wagner1982).

Some of the most frequent complaints following third molar surgery, according to the work of Oikarinen in 1991 and Kim in 2006, are pain and trismus. Fisher in 1988, showed that trismus and swelling are closely associated with acute inflammation following third molar surgery.

The main contributing factors to postoperative swelling are the duration and the degree of difficulty of the operation (de Boer *et al.*1995).

Using panoramic radiographs, mandibular impactions can be classified using the Pell and Gregory (Pell, Gregory 1933) classification (Table 1), and, for maxillary impactions, the Archer (Archer 1966) classification (Table 2).

One of the controversies surrounding swelling, is the effect of gender and age (Osborn *et al.* 1985). A major contributor to ecchymosis and petechiae, is the inflammatory reaction and capillary fragility that occurs postoperatively (De Paepe and Malfait, 2004). Preventing this will be beneficial due to its unaesthetic

appearance (Kim *et al.* 2006). Hormonal imbalance and underlying systemic disorders have been described as causes of post extraction bleeding (Haytac *et al.* 2004).

Table 1: The Pell-Gregory classification of lower impacted third molars

(1) Relation of the tooth to the ramus of the mandible
     Class I: Sufficient amount of space between the ramus and distal of the second molar for the accommodation of the mesiodistal diameter of the crown of the second molar.
     Class II: The space between the ramus and the distal of the second molar is less than the mesiodistal diameter of the crown of the third molar.
     Class III: All or most of the third molar is within the ramus of the mandible

(2) Relative depth of the third molar in bone
     Position A: The highest portion of the tooth on a level with or above the occlusal line.
     Position B: The highest portion of the tooth below the occlusal line, but above the cervical line of the second molar.
     Position C: The highest portion of the tooth on the level with or below the cervical line of the second molar.

(3) The position of the tooth in relation to the long axis of the second molar
     (i) Vertical   These may also occur in
     (ii) Horizontal   (a) Buccal deflection
     (iii) Inverted   (b) Lingual deflection
     (iv) Mesioangular   (c) Torsion
     (v) Distoangular

Table 2: Archer classification for upper impacted third molars

(1) Relative depth of the impacted maxillary third molars in bone
Class A: The lowest portion of the crown of the impacted maxillary third molar is on a line with the occlusal plane of the second molar.
Class B: The lowest portion of the crown of the impacted maxillary third molar is between the occlusal plane of the second molar and the cervical line.
Class C: The lowest portion of the crown of the impacted maxillary third molar in relation to the long axis of the second molar.

(2) The position of the long axis of the maxillary third molar in relation to the long axis of the second molar

(i) Vertical   These may also occur simultaneously in
(ii) Horizontal   (a) Buccal version
(iii) Mesioangular   (b) Lingual version
(iv) Distoangular   (c) Torsoversion
(v) Inverted
(vi) Buccoangular
(vii) Linguoangular

(3) Relationship of the impacted maxillary third molar to the maxillary sinus
Sinus approximation
No bone or a thin portion of bone between the impacted maxillary third molar and the maxillary sinus
No sinus approximation
2 mm or more of bone between the impacted maxillary third molar and the maxillary sinus

Complications which can recover without further treatment can be defined as minor. Complications needing further treatment and those resulting in irreversible consequences, can be regarded as major (Kim *et al.* 2006). There have been many reports of complications in third molar surgery, such as abscess formation, excessive bleeding, mandible fractures and nerve injuries (Osborn *et al.* 1985).

Genu *et al.* (2008) concluded that injury to the inferior alveolar nerve is a well documented complication of maxillofacial procedures such as dentoalveolar surgery, mandible fractures, tumour resections, preprosthetic and orthognathic surgery. "It is in cases of elective surgical removal of third molars that it has attracted most attention. The resultant altered sensation or anaesthesia of the lower lip is an unpleasant condition, and in addition to its psychological consequences it is becoming a common cause of litigation" (Miloro *et al.* 2002).

Susarla and Dodson (2007) stated that the percentage of nerve damage ranges from 1 to 22%. When the surgeon has a good knowledge of anatomy and uses the appropriate technique, the incidence of neural injuries can be dramatically reduced.

Third molar surgery can commonly cause injury to the inferior alveolar nerve, less frequently to the lingual nerve, and rarely to the buccal nerve (Littner *et al. 1*986). The proximity of the dental apices to the mandibular canal is often a cause of injury. The close relationship of the mandibular canal to the apices of these teeth is important. According to Littner *et al* (1986), the exact location of the roots of impacted lower third molars in relation to the mandibular canal must be determined by radiography before any surgery is undertaken. The classification of Felez-Guiterez *et al.* (1997) modified by Gomes (2001) can be used to determine whether there are any radiographic signs of a close relationship between the tooth root and the mandibular canal.

In the treatment of minor complaints, numerous adjunct modalities have been used and proven to be beneficial. These include medication, physiotherapy and cold therapy.

Many therapeutic protocols have been implemented and evaluated to improve the postoperative period. These include preoperative antibiotic administration (Lawler *et al.* 2005), the use of different kinds of flaps (Jakse *et al.* 2002), osteotomy by high or low speed instruments (Horton *et al.* 1975), draining/not draining the wound (Cerquiera *et al.* 2004), the use of a postoperative ice pack (Van der Westhuijzen *et al.* 2005), postoperative administration of several antibiotics (Poeschl *et al.* 2004), cortisone administration by systemic route (Alexande and Throndson 2000) and topical application of cortisone (Ustun *et al.* 2003).

The use of steroids in third molar surgery has been extensively researched by Graziani *et al.* (2006), Esen *et al. (*1999) and Alexander (2000). According to trials by Esen in 1999, Holland in 1987 and Schultze-Mosgau in 1995, postoperative methylprednisone after third molar surgery leads to a reduction in pain, swelling and trismus. Low dose methylprenisone prior to, and again after surgery, reduced postoperative swelling markedly according to Milles (1993).

Van der Westhuijzen *et al.* in 2005 found that postoperative ice pack therapy did not significantly reduce pain, swelling and trismus. The findings with regard to trismus corresponded with those of Rodrigues (2005) - however he concluded that postoperative cryotherapy reduced pain and swelling. In a study by Otto 2007, the efficacy of a six-day chewing gum regimen in reducing pain, swelling and trismus after third molar surgery was compared to no chewing gum therapy. The study group followed a prescribed regimen of chewing sugarfree gum. Swelling was less in chewers but not significantly so. The results of this study suggest that trismus can be reduced by using a five-day chewing gum regimen after surgery.

For the past two decades ultrasonic vibrations have been used to cut tissue. However, it is only in the last five to six years that experimental applications have been used routinely for standard clinical applications in many different fields of surgery (Sherman and Davies 2000). Cutting tissue with ultrasonic vibarions "decreases the risk of damage to surrounding soft tissues and critical structures (nerves, vessels, and mucosa, particularly during osteotomy" (Labanca *et al*. 2008).

The indirect piezoeffect is generated by a deformation of a piezoelectric crystal in an electric field. It can be used not only for scaling subgingival concrements and plaque, but also for removing root canal fillings and fractured instruments from root canals. (Ward *et al*. 2003) "Based on the experience gained with the ultrasonic scalpel, the application of focused ultrasound for non-invasive osteotomy (Walmsley *et al*. 1990), as well as the use of ultrasonic vibration drills in traumatology (Kvashin *et al*. 2001), the advantages of piezosurgery can also be used for intraoral osteotomy techniques" (Stubinger *et al*. 2005).

The micromovements that are created at the frequency of 25–29 kHz are used, because this frequency cuts only mineralised tissue. At frequencies higher than 50 kHz neurovascular tissue and other soft tissue is cut (Eggers *et al.* 2004).

Piezosurgery is superior to conventionally rotating instruments in operations where the area of interest is adjacent to nerves, such as when impacted third molars are in close proximity to the inferior alveolar canal, or in bilateral sagittal split osteotomies performed close to the mental foramen.

Geha *et al.* (2006), assessed the sensitivity of the inferior lip and chin after mandibular bilateral sagittal split osteotomy in twenty patients using piezoelectric surgery. They found that, in all of the cases, the inferior alveolar nerve was not affected, although there was no comparison with the standard technique for

bilateral sagittal split osteotomy.

The advantages of the piezo-osteotomy can also be applied to implantology. There is a much lower risk of perforation to the sinus lining during sinus lift procedures since soft tissue cannot be damaged with this method (Stubinger *et al.* 2005).

"Piezoelectric techniques were developed in response to the need for greater precision and safety in bone surgery than was available with other manual and motorized instruments" (Labanca *et al.* 2008).

In regenerative surgery the effects of mechanical instruments on the structure of bone and the viability of cells is important. High temperatures are dangerous to cells and cause necrosis of tissue. There have been several studies about the effect of piezoelectric surgery on bone and the viability of cells which showed that it is a favoured technique in bone harvesting (Vercellotti *et al.* 2005).

Piezoelectric devices are a safe and effective alternative for osteotomy or osteoplasty compared with traditional hard and soft tissue methods that use rotating instruments. It is easy to control and allows for safer cutting, particularly in complex anatomical areas. Piezoelectric bone surgery seems to be more efficient in the first phases of bony healing; it induces an earlier increase in bone morphogenetic proteins, controls the inflammatory process better, and stimulates remodeling of bone as early as fifty-six days after treatment according to Preti *et al.* (2007).

In a study carried out by Sortino *et al.* in 2008, postoperative outcome was compared in mandibular third molars treated by piezoelectric surgery or by rotary osteotomy technique. One hundred patients with impacted mandibular third molars were included in the study. Fifty patients were treated by rotary osteotomy technique and fifty by the piezoelectric osteotomy technique. In both

groups, odontotomy was always completed with a tungsten carbide fissure bur at high speed, taking care to avoid contact with bone. Twenty-four hours after surgery, two different parameters, facial swelling and trismus, were evaluated in both groups. They concluded that the piezoelectric osteotomy technique produced a reduced amount of facial swelling and trismus twenty-four hours after surgery, but a longer surgical time was required when compared with the rotary osteotomy technique.

Patients and methods

Routine patients attending the Maxillo-Facial and Oral surgery outpatient clinic at the Faculty of Dentistry and WHO Collaborating Centre of UWC were selected for the study.

Patients, 18 years and older, irrespective of sex or race, with four impacted third molars that were mirror images of each other, were included in the study. All patients were treated under general anaesthesia. Visually and mentally challenged patients, and those with haemostasis abnormalities and reduced immunity were excluded. Patients with third molar infections (pain and swelling) and those on antibiotics, non-steroid anti-inflammatory or herbal drugs were also excluded. Patients included in the study did not use postoperative ice-pack therapy. Psychiatric and mentally challenged patients were excluded as it was imperative that patients could express and record their data accurately.

All patients gave written informed consent for the procedure and participating in the study, and they all received an information leaflet in English, Afrikaans or Xhosa. The thirty patients included in the study all presented with four impacted third molars that were mirror images of each other as evaluated on pantomographic radiographs.

To determine whether there was any radiographic signs of a close relationship between the lower third molar and the mandibular canal, the classification of Felez-Gutierez *et al.* (1997), modified in 2001 by Gomes, was used. The split-mouth technique was used: two impacted third molars (on one side) were removed using a conventional drill, while the other two (on the other side) were removed with a piezoelectric device in an analytical prospective case series. A

flip of a coin determined which device was to be used for which side. The surgical procedures were performed by a single operator.

The University of the Western Cape (UWC) approved and registered the protocol with regard to research principles and ethics.

Anaesthetic management

An anaesthetist administered a standardized general anaesthesia. Nasotracheal intubation was performed after intravenous induction with propofol, (2 mg/kg) and alcuronium, (0.3 mg/kg). General anaesthesia was maintained by isoflurane, nitrous oxide and 35% oxygen. Cardiac function was monitored with electrocardiography and the blood pressure was monitored by an intermittent automated sphygmomanometer. Respiratory function was monitored by capnography and pulse oximetry.

Surgery

Surgery was performed by the same operator (registrar within the Department of Maxillo-Facial and Oral surgery of UWC). An envelope mucoperiosteal flap was raised exposing the third molar.

Bone was removed under constant sterile 0,9% saline irrigation on the buccal and distal aspect of the third molar with a number eight surgical bur on the one side and a piezoelectric device (Surgybone$^®$) using the SB P0610 – 120° sharp lance for extraction and removal of teeth, with prescribed settings *pwr ult* : 46(power), *vibra* :100(frequency) and p045 (water), on the other side or vice versa.

Crown amputation and root division was done with the respective devices in the two different groups. Tooth elevation, as required, was done with Warwick James or Coupland elevators. After removal of the tooth, the surgical field was meticulously rinsed with sterile 0.9% saline. The wound was closed by placing 3-0 interrupted chromic sutures.

The Surgybone[®] (Silfradent)

Photograph 1: Surgybone[®]

Surgybone[®] (Photograph 1), the electromedical equipment by Silfradent Srl, is a dental instrument performing operations by means of ultrasound vibrations produced by a piezoelectric transducer. The equipment consists of a console including an electronic control circuit and an ultrasound control circuit, a piezoelectric handpiece and a peristaltic pump. Suitable tips are mounted to the piezoelectric handpiece.

The system is based on a sophisticated ultrasound control structure, which carries out electrical resonance handpiece control by means of current measurement. All operations are displayed and controlled by a card through a

monitor and a keyboard. The integrated pump is used to transport the sterile coolant from its vessel to the preparation point. It is used for periodontal, implant, oral, maxillofacial and endodontic surgery. The equipment uses tip ultrasound microvibration, thus overcoming the limitations of traditional methods in terms of precision and safety, with significant advantages to the patient.

Micrometric cutting allows for the use of osteoplastic and osteotomy techniques providing maximum visibility, precision and safety together with minimum tissue damage. Using micrometric cutting (40/200 micron vibration), overheating is avoided, keeping the bone clean and cool while the tool cuts. Being specific for hard tissue, the selected power and frequency minimize the risk of soft tissue lesions. The limited vibration amplitude makes the cutting process safe: even in the event of an operator mistake on nervous and soft tissue, there would be no immediate damage, unless an incorrect, continuing action is performed.

It is extremely important to interrupt the Surgybone®'s action to avoid soft tissue overheating, as the excess energy used on soft and hard tissue is transformed into heat.

The Surgybone® is designed to be mounted on a trolley or table, and it is equipped with an LCD display and a keyboard with touch buttons and lighting. The basic version consists of a console with a display (2 lines x 16 digits), a foot control, a peristaltic pump and a supply cable.

The machine has two functions viz. *surgy* and *endos*. Each function has ten programs to set according to the surgeon's requirements. The power of the handpiece transducer (*pwr ult*) allows for the temporary modification of the ultrasound power and appears as a value on the display from 00 to 50. The frequency of the handpiece transducer (*vibra*) allows for the temporary increase or decrease of the vibration and appears as a value on the display from 00 to 100 as a percentage. The coolant flow rate (peristaltic pump) allows for the temporary

increase or decrease of the flow rate and depicted as a percentage from 00 to 100.

All residue must be removed before sterilization by thoroughly washing and cleaning both the handpiece and tips. The sterilizable parts are the cable and handpiece, tips and the saline holding rod. Whenever possible, sterilization should be carried out using water or chemical vapour at 121° Celsius (Surgybone® product manual, Silfradent Srl).

SB P0610 – 120° sharp lance for extraction and removal of teeth

Photograph 2: SBP0160 120°sharp lance

The NSK Surgic XT® (Standard surgical handpiece)

Photograph 3: NSK Surgic XT®

The Surgybone® has a powerful and reliable surgical micromotor designed specifically for oral and implant surgery. It has 210 W high power and 50 Ncm powerful torque, together with a wide speed range of 200 - 40 000 rpm.

It has a user-programmable preset memory which enables the saving of up to ten preferred settings for speed, torque, coolant flow and rotational direction.

The unit consists of a foot control unit, console, handpiece and cable, and irrigation supply (Surgic XT® product manual, NSK).

Photograph 4: Number 8 round burr

Peri-operative medication

All patients received the same pre- and postoperative medication. 1000 mg of paracetamol and 400 mg of ibuprofen, six hourly, was prescribed for pain and swelling. For antibiotic prophylaxis, 1 g of amoxicillin was given preoperatively followed by 500 mg of amoxicillin eight hourly for two days. (No patients were allergic to penicillin in the study.) Ten to 15 ml of chlorhexidine gluconate (0.2%) mouthwash was prescribed for five days to be used after meals.

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Study design

All patients were preoperatively examined, and assessed via pantomographic radiography as per standard protocol.

Data capture sheets were prepared to capture all patient information and the duration of surgery in minutes from the start of incision to the end of suturing. The amount of intraoperative bleeding was measured by means of a visual analogue scale. Postoperative swelling and pain was measured twenty-four hours postoperatively by means of a visual analogue scale.

The presence of complications such as trauma to intra-oral soft tissue and the lip were assessed at the end of surgery. The presence of paraesthesia was assessed twenty-four hours postoperatively. All data were captured on a data capture sheet and analysed statistically.
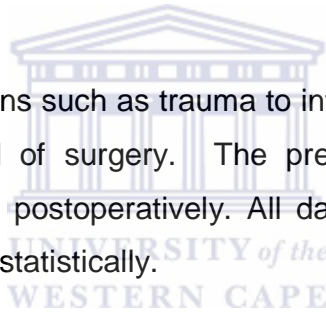
Results

Statistical analysis was performed by Theodata® using the Microsoft Excel® software package. A total of thirty patients were operated with a total operating time of 805 minutes, averaging twenty-six minutes per case as depicted in Figure 1.
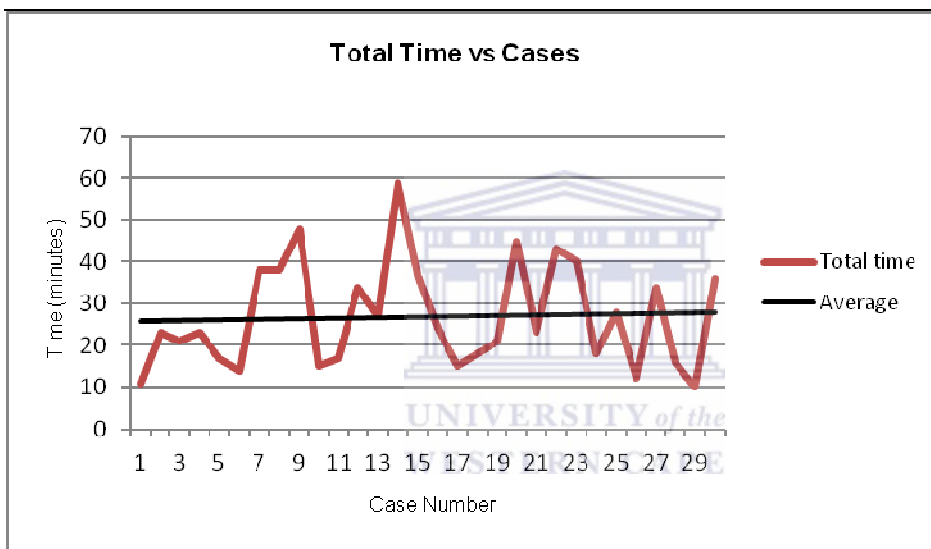

Figure 1: Total time vs. cases

A total of 400 minutes was spent on the right-hand side averaging 13.33 minutes per case as depicted in Figure 2.
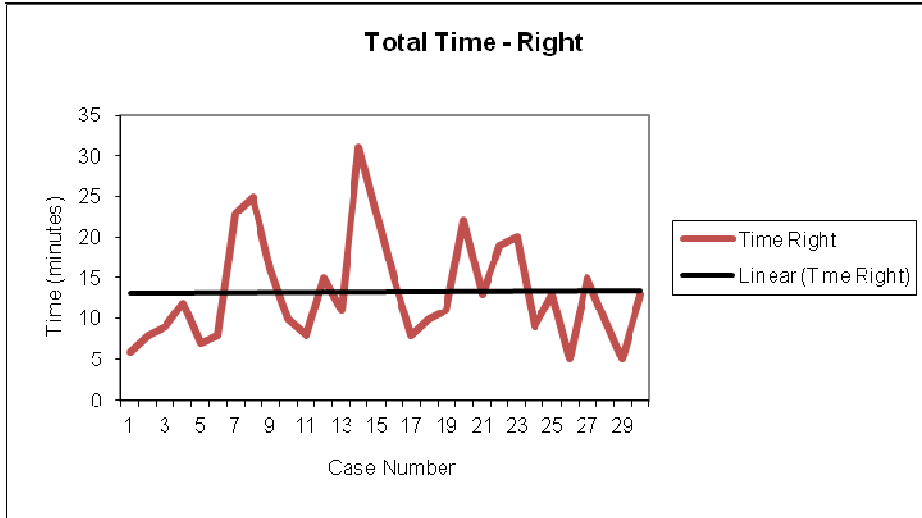
Figure 2: Total time: right

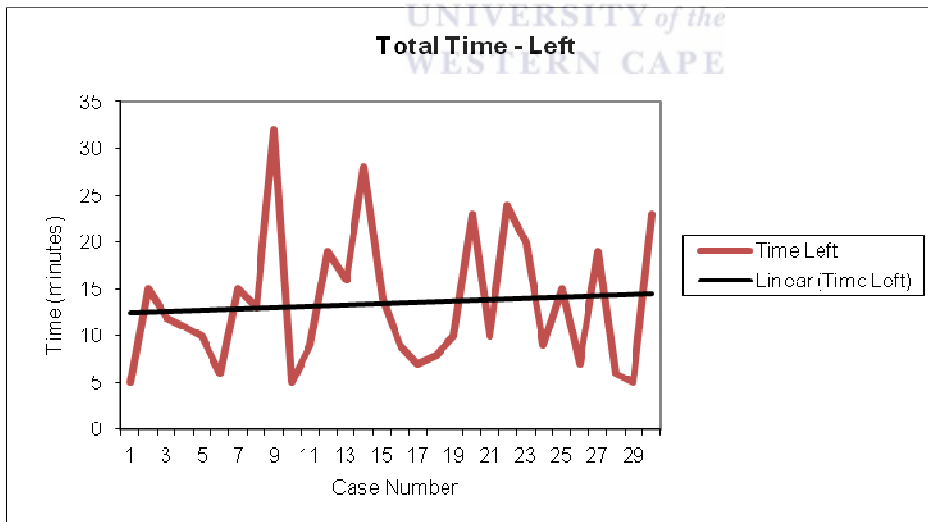A total of 405 minutes was spent on the left-hand side averaging 13.5 minutes per case as depicted in Figure 3.

Figure 3: Total time: left

A summary of total surgical time, and time taken on the respective sides using the Surgybone® and drill is shown in Figures 4 and 5. The average time of surgery on the right was 13.33 minutes and on the left 13.5 minutes.
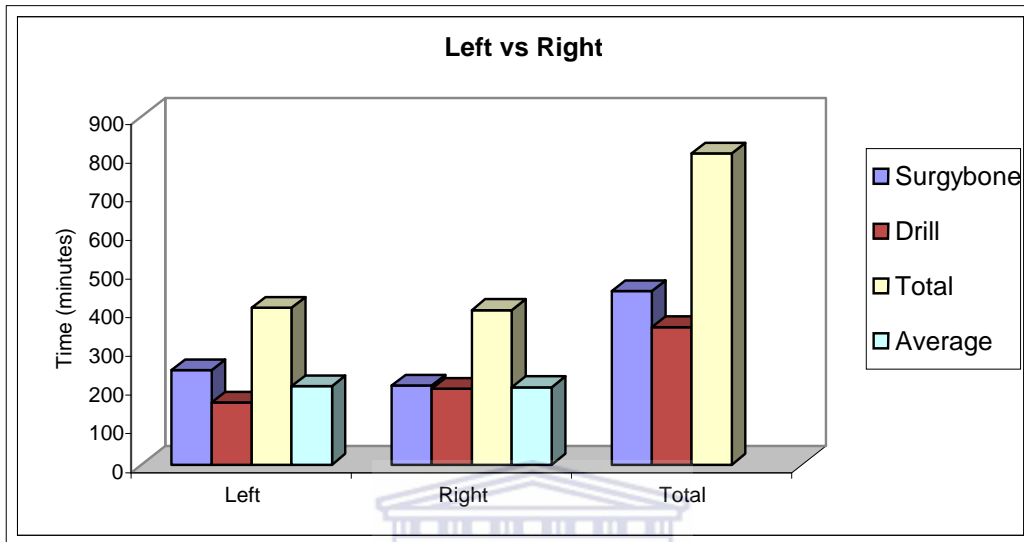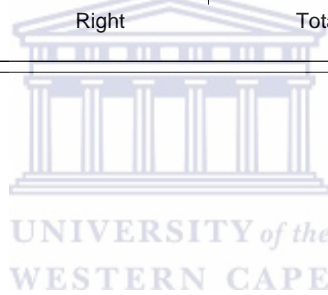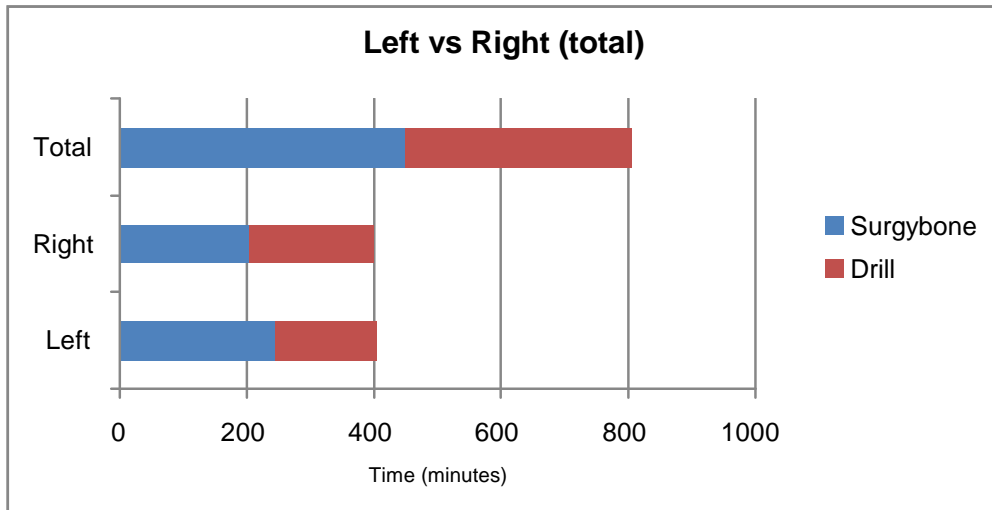

Figure 4: Left vs. right

Figure 5: Left vs. right (total)

The following graph (Figure 6) illustrates the surgical time for the Surgybone® and the drill as the cases progressed in the study series.
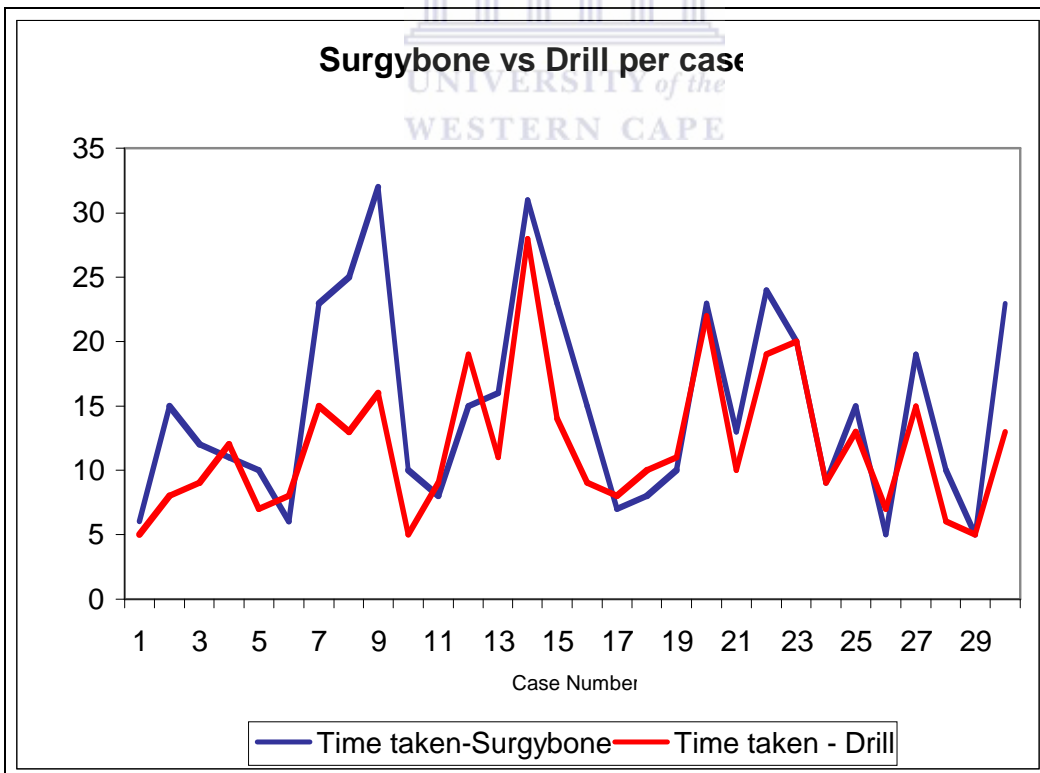
Figure 6: Surgybone® vs. drill per case

The sample standard deviation = 4.6338 with a sample mean of –3,1 and p value of 0,001. The average time taken with the Surgybone® per case was 14.97 minutes and the drill was 11.87 minutes.
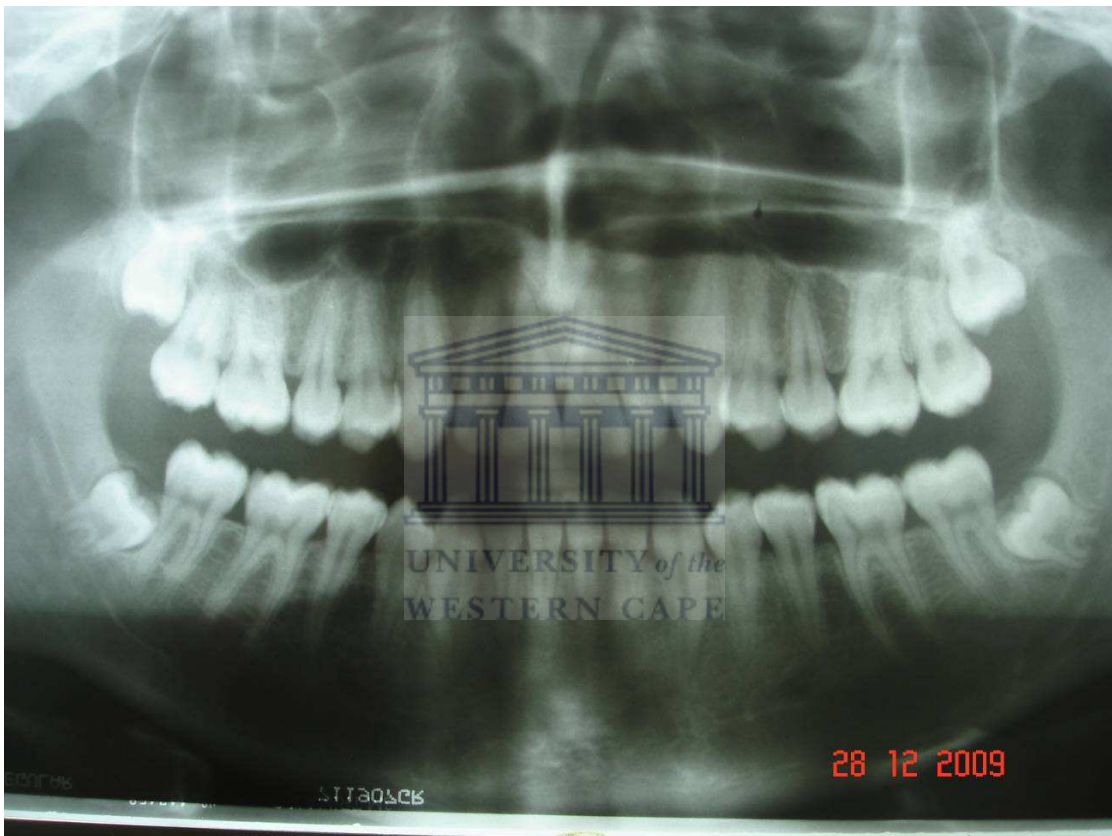
Right   Left
Photograph 5: Panoramic radiograph: case 7

The Surgybone® was used on the right-hand side in the above case 7 with a total operating time of twenty-three minutes as opposed to fifteen minutes with the drill on the left-hand side. The patient complained of more swelling on the right-hand side but experienced less pain than on the left-hand side. There were no other complications.

In case 10 the Surgybone$^{®}$ was used on the right-hand side and the drill on the left.

Photograph 6: Pre-operative photograph: case 10

Right   Left

Photograph 7: Panoramic radiograph: case 10

The cutting time on the right-hand side was ten minutes as opposed to five minutes on the left with the drill. The patient reported significantly more pain and swelling on the left-hand side.
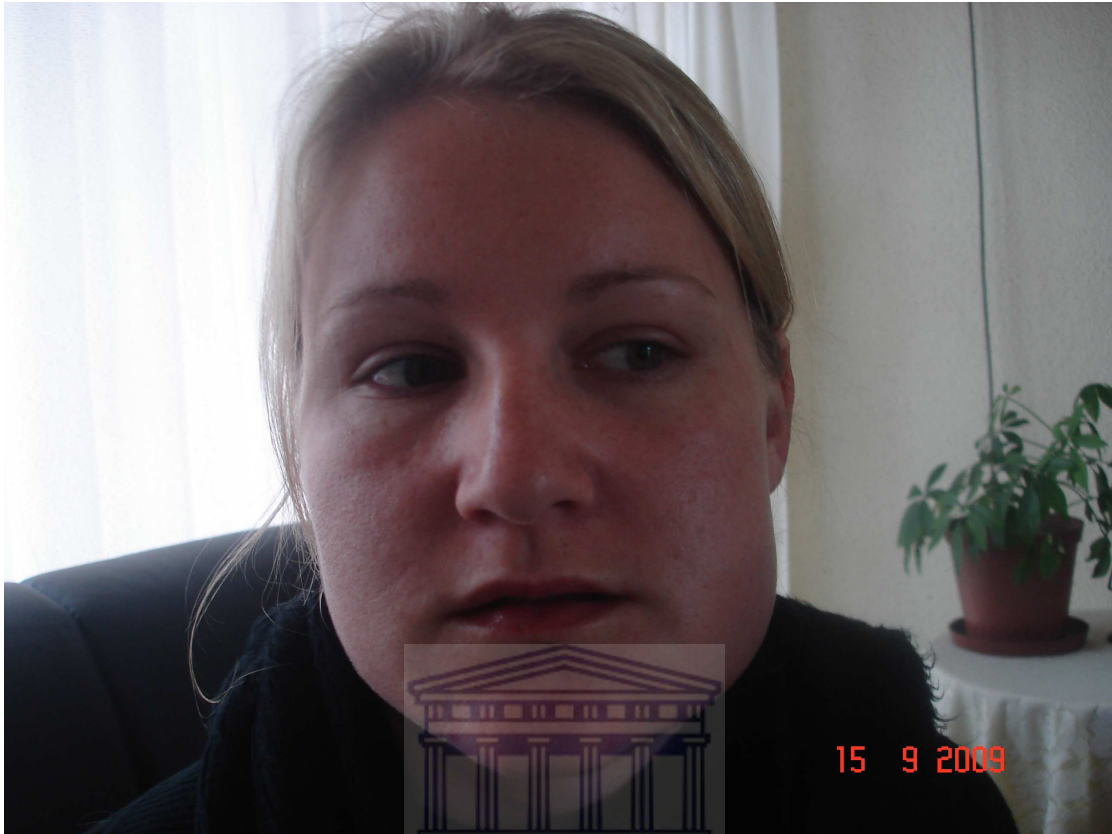
Photograph 8: Postoperative photograph: case 10

Pivot tables (Table 3) were used to evaluate swelling based on patient responses via a visual analogue scale (Appendix 3) twenty-four hours postoperatively. Surgybone® was used on the left and the drill on the right:

Count	Post-Op Swelling Right(Drill)					
Post-Op Swelling Left (Surgybone®)	0	1	2	3	4	Total
1	1	1	6			8
2		2		1	1	4
3			2		1	3
4			1			1
5					1	1
Total	1	3	9	1	3	17

Table 3: Pivot table: postoperative swelling

One patient experienced the same and nine patients had more swelling on the right-hand side caused by the drill. Seven patients had more swelling on the left caused by the Surgybone®.

Postoperative swelling data is depicted in Table 4 for using the Surgybone® on the right and the drill on the left:

Count	Post-Op Swelling Right(Surgybone®)			
Post-Op Swelling Left (Drill)	1	2	3	**Total**
1	1	3		4
2	3			3
3		5	1	6
Total	4	8	1	13

Table 4: Pivot table: postoperative swelling

Two patients experienced the same swelling, and eight had more swelling on the left-hand side caused by the drill. Three patients had more swelling on the right-hand side created by the Surgybone®.

Data depicted in Tables 3 and 4 are combined in Table 5:

Comparison of swelling	
Drill	17
Surgybone	10

Table 5: Post-operative swelling (combined)

Though the drill created more swelling, it was not statistically relevant with a probability 0,1239 and significance = 0,2478.

Pivot tables were also used to evaluate pain based on patient responses via a visual analogue scale (Appendix 3) twenty-four hours postoperatively. Table 6 depicts pain when the drill was used on the left and the Surgybone® on the right:

Count	Post-Op Pain Right		
Post-Op Pain Left	1	2	**Total**
0		1	1
1	1	3	4
2	1	4	5
3	1	2	3
Total	3	10	13

Table 6: Pivot table: postoperative pain

Five patients experienced the same pain and four experienced more pain on the left-hand side caused by the drill. Four patients had more pain on the right-hand side caused by the Surgybone®.

Table 7 depicts pain when the Surgybone® was used on the left and the drill on the right:

Count	Post-Op Pain Right					
Post-Op Pain Left	0	1	2	3	4	**Total**
1			7			7
2	1	2	1		1	5
3			1	1	1	3
4			1		1	2
Total	1	2	10	1	3	17

Table 7: Pivot table: postoperative pain

Three patients had the same pain experience and nine had more pain on the right-hand side caused by the drill. Five patients had more pain on the left-hand side caused by the Surgybone®.

Table 8 depicts "combined" postoperative pain.

Comparison of pain	
Drill	13
Surgybone	9

Table 8: Post-operative pain (combined)

The drill thus caused more pain than the Surgybone®, but not statistically so. (Using Fishers test for change probability = 0,2617 and significance =0.5235.)

Bleeding was evaluated intraoperatively by a single operator and compared by means of a visual analogue scale (Appendix 3) in Figure 7.
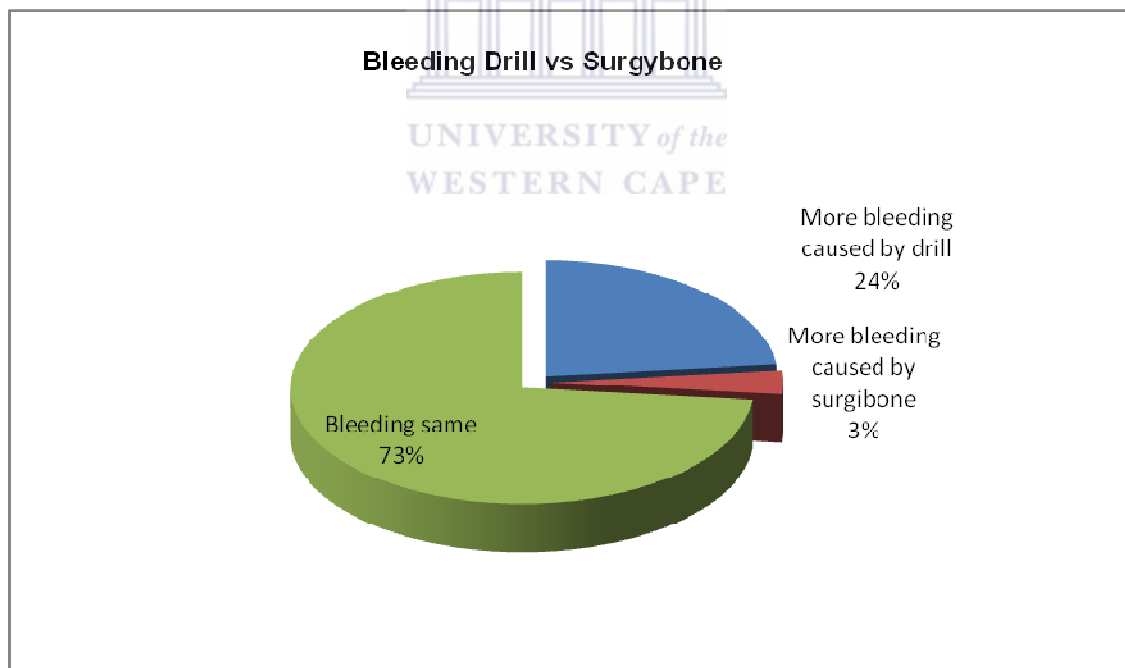
Figure 7: Bleeding Drill vs. Surgybone®

In twenty-two cases the bleeding was the same and in one case the Surgybone® caused more bleeding than the drill. In seven cases the drill caused more

bleeding than the Surgybone®. Therefore significantly less bleeding occurred with the Surgybone®– significance = 0.007.

As depicted in Figure 8, in twenty of the sides (i.e. L or R), the inferior alveolar nerve was considered to be in close proximity to the lower third molar using the classification by Felez-Gutierez *et al.* and modified by Gomes.

Figure 8: Nerve involvement

There were two cases of paraesthesia twenty-four hours postoperatively, both caused by the drill.

Figure 9: Postoperative paraesthesia

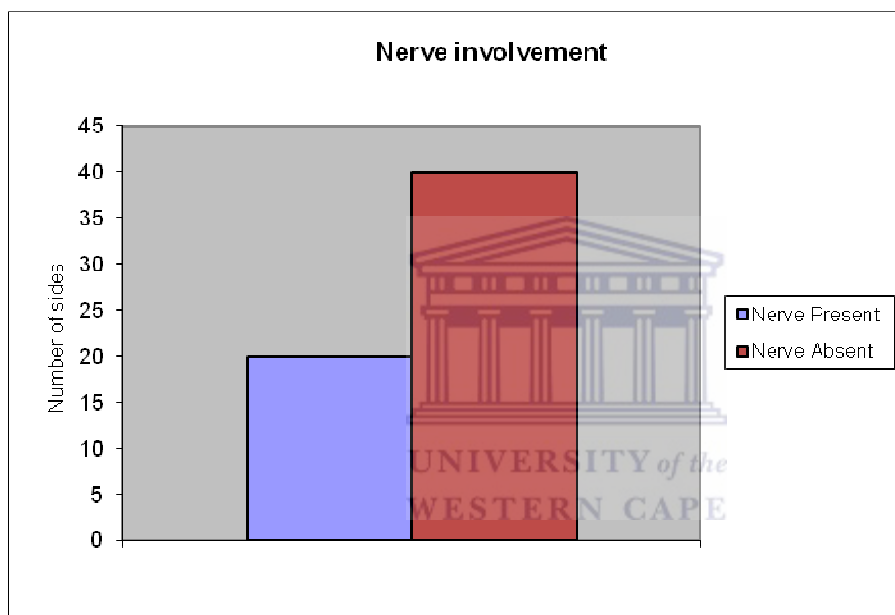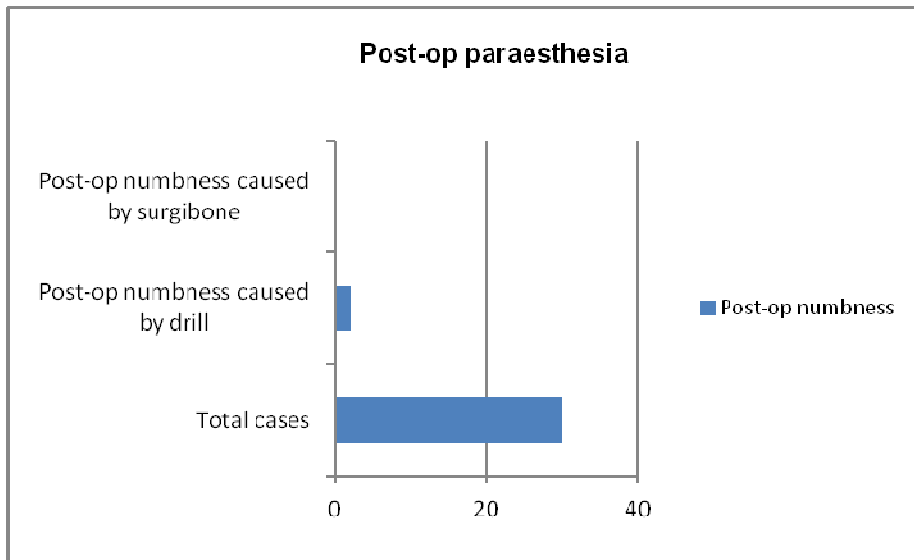There were no incidences of any damage to teeth or trauma to the lip or intra-oral soft tissue.

Discussion

The aim of this study was to compare the use of a piezoelectric and a standard surgical handpiece in the removal of third molars in terms of surgical cutting time, intraoperative bleeding and postoperative soft tissue injuries, swelling, pain and paraesthesia.

The results of the comparative study showed that, compared to rotary techniques, the piezoelectric device reduced postoperative swelling and pain, and allowed for a more comfortable postoperative time although it increased the duration of the surgery.

The average time taken with the Surgybone® per case was 14.97 minutes compared to 11.87 minutes with the drill. In some cases (7-10) there was a marked difference in operating time with the two devices. This can be attributed to the level of difficulty of surgery requiring extensive bone removal and multiple tooth sectioning, in which the drill had superior performance to the Surgybone®.

In a study carried out by Sortino *et al.* in 2008, postoperative outcome was compared in mandibular third molars treated by piezoelectric surgery or by rotary osteotomy technique. One hundred patients with impacted mandibular third molars were included in the study. Fifty patients were treated by rotary osteotomy technique and fifty by the piezoelectric osteotomy technique. In both groups, odontotomy was always completed with a tungsten carbide fissure bur at high speed, taking care to avoid contact with bone. Time of surgery was considered from the start of incision to the end of suturing. Twenty-four hours after surgery, two different parameters, facial swelling and trismus, were evaluated in both groups. They concluded that the piezoelectric osteotomy technique produced a reduced amount of facial swelling and trismus twenty-four

hours after surgery, but a longer time was required when compared with the rotary osteotomy technique.

The current study included thirty patients. The split-mouth technique was used in an analytical prospective case series, i.e. two impacted third molars (on one side) were removed using a conventional drill, and the other two (on the other side) were removed with a piezoelectric device. Odontotomy in this study was performed on all teeth with their respective devices. The duration of the surgery was measured from the start of incision to the end of suturing. This study further evaluated postoperative pain, swelling, trismus and paraesthesia twenty-four hours after surgery.

With regards to swelling and time duration, our findings correspond with the findings of Sortino *et al.*, even though we opted to perform the odontotomy with the respective devices. Although more time consuming, the Surgybone® performed the task adequately.

Photograph 9: Odontotomy Surgybone®

Photograph 10: Odontotomy Drill

With regards to intraoperative bleeding, the two sides were compared and recorded by the operator on a visual analogue scale. In 74 % of the cases the bleeding was found to be the same, with more bleeding caused by the drill in 23% and the Surgybone® in 3% of cases. Measurement of the actual blood loss could be included in a subsequent study.

The Surgybone® caused less pain and swelling, although not statistically so i.e. pain (p=0,2617) and swelling (p=0,1239). Physical measurement of the swelling could also be included in a subsequent study.

Conclusion

Although more time consuming, the Surgybone® is an acceptable alternative to the standard surgical handpiece in third molar surgery. Its use is advocated in difficult cases - especially where there is inferior alveolar nerve proximity.

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WESTERN CAPE

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Cape Town

2009

(Appendix-1)

Patient Information Letter

Pasiënt informasie

I, Dr I Gopal, plan to conduct a clinical study to compare 2 types of surgical "drilling" techniques used to remove your wisdom teeth. The one is a "rotating" and the other a "vibrating-type" drill. Both techniques are routinely used in bone surgery. We do not think there is a difference in the 2 techniques. The only way we can find out if the one is superior to the other, is to do such a study. This will obviously benefit all future patients. Participating in the study is on a voluntary basis and all information will be kept strictly confidential. Participating in the study will not harm or prejudice you in any way. Participating in the study will definitely benefit future patient.

Ek, Dr I Gopal, beplan 'n kliniese studie om die effektiwiteit te evalueer van 2 boor tegnieke om u verstandtande te verwyder. Die een is 'n "roteerende" en die ander 'n "vibreerende" boor tegniek. Beide tegnieke word roetinelik gebruik om been te verwyder. Ons dink nie daar is 'n verskil in sukses tussen die twee tegnieke nie. Ons wil graag uitvind of die een tegniek wel superior is. Om deel te neem in die studie, sal u nie nakom nie. Deelname is totaal vrywillig en alle informasie sal vertroulik hanteer word. Deelname in die studie sal toekomstige pasiënte bevoordeel agv die inwin van nuwe kennis.

Thanking you in anticipation.
Dankie vir u samewerking

Dr I Gopal

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Faculty of Dentistry & WHO Oral Health Collaborating Centre

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Consent form:

(Appendix-2)

I   Mr/Miss/Mrs.

……………………………………………………………………………….

Date of birth_____File no: or sticker:

am willing to participate in the above mentioned study. I understand that the study is voluntary.

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 have being adequately informed about the objectives 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: _____

Date: _____

Signature of the Researcher:_____

Dr I Gopal

Date: _____

Data Capture Sheet (Appendix-3)

Case Nr :……

Patient:……………………… **Folder nr**:…………………………

Device

Right side:………………… **Left side**…………………………..

Teeth……………………………**Teeth**…………………………..

……………………………………. …………………………………………

Nerve approximation

Right………………..   **Left**…………………

Time

Right………………..   **Left**……………………

Bleeding
VAS scale to evaluate bleeding

+	Greater than	Bleeding on this side is more than the other side
	Same	Bleeding is the same on both sides
-	Less than	Bleeding on this side is less than the other side

Pain
VAS scale to evaluate pain : reference values given to patients

0	No pain	The patient feels well
1	Slight pain	If the patient is distracted, he or she does not feel the pain.
2	Mild pain	The patient feels the pain even when concentrating on some activity
3	Severe pain	The patient is very disturbed but nonetheless can continue with normal activities
4	Very severe pain	The patient is forced to abandon normal activities
5	Extremely severe pain	The patient must abandon every type of activity and feels the need to lie down

Swelling
VAS scale to evaluate swelling : reference values given to patients

0	No swelling	The patient does not detect the slightest swelling
1	Slight swelling	The patient detects a slight swelling but it is not very noticeable
2	Mild swelling	The swelling is noticeable but does not interfere with normal swallowing and mastication
3	Severe swelling	The swelling is evident and hinders normal mastication
4	Very severe swelling	The swelling is marked. Mastication is hindered but there is no reduction in mouth opening
5	Extremely severe swelling	The swelling is evident and mouth opening is reduced