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Original Article

The efficacy of 3 irrigating solution in surgical removal of lower wisdom tooth: a pilot study

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Abstract Surgical removal of impacted lower wisdom tooth has become increasingly costly to patient while still remains as the most common dental surgical procedure that is performed on outpatient basis. In the present study, a total of 23 patients with impacted lower wisdom tooth were surgically removed under local anaesthesia by using different irrigating solution namely, normal saline, distilled water and chlorhexidine. The samples underwent standard operating procedures and medication. Post operative complications in terms of pain, swelling, infection and delayed wound healing were assessed and compared on Day 1 and Day 7 after surgery. The result of this study showed that there is no significant difference between the three irrigating solution used in surgical removal of impacted lower wisdom tooth in terms of postoperative complication. A bigger scale of research with more samples is recommended to evaluate the most efficacy irrigating solution during surgical removal of impacted lower wisdom tooth.

Keywords: chlorhexidine, distilled water, irrigating solution, normal saline.

Introduction

Removal of impacted wisdom tooth is the most common dental surgical procedure performed in dental surgery (NICE, 2000). Irrigating solution that is used during surgical removal of the wisdom tooth does not only prevent injury to the bone but also irrigates the working field and improves the vision of the dentist. In previous animal studies, it was shown that cutting the bone without water spray had significantly produced a greater width and intensity of inflammatory exudates and cellular debris at the margins of the defect compared to those with irrigation when viewed under the microscope (Costich *et al.*, 1964). However, there are very few studies on the types of irrigating solutions used during surgical procedure in the human oral cavity. Most of the studies were focused on the type of irrigation used as a cleanser for chronic wound on other parts of the human body (Angerås *et al*., 1992; Petrisor *et al*., 2011).

Normal saline is the most common irrigating solution used among the dental professionals during the surgical removal of lower impacted wisdom tooth and is recommended as the best cleansing solution for human body wound (Glide, 1992; Bergstrom *et al.*, 1994; Lawrence, 1997). On the other hand, Koerner (1994) had recommended sterile water and normal saline as the irrigating solution during surgical removal of wisdom tooth. The authors believed that both irrigants are sterile and able to reduce the heat that was generated during the surgery. Furthermore, these irrigants can also keep the surgical field clean.

Petrisor *et al.* (2011) had emphasized that normal saline is preferred than sterile water because it is isotonic with physiological properties of human body and therefore it is safer to the body.

Study on the efficacy of distilled water and chlorhexidine as irrigating solutions for surgical removal of lower wisdom teeth are limited, although chlorhexidine is well known for its antibacterial properties among the dental professionals. Distilled water that is prepared by distillation is sterile and economic (Petrisor *et al.*, 2011). However, distilled water is hypotonic and therefore can cause haemolysis by absorbing into the tissues during surgery. As a result, wound healing would be compromised.

The use of distilled water, isotonic saline and boiled water to clean the open fractures wound would not show any significant difference in terms of wound infections and healing rates (Fernandez and Griffiths, 2012). Previously, Angerås *et al.* (1992) found significant decrease of infection rate in wounds cleansed with tap water compared to the wound cleansed by normal saline.

The objective of the present study is to compare the cost effectiveness and the efficacy of normal saline, distilled water and chlorhexidine as irrigating solutions on the surgical removal of lower wisdom teeth by comparing the post-operative clinical complication.

Materials and methods

The study was conducted in the oral surgery clinic of Universiti Sains Islam Malaysia (USIM), Kuala Lumpur from March to August 2014. The samples were patients with indication for surgical removal of impacted lower wisdom tooth (NICE, 2000). The study comprised of initial screening, taking informed consent, surgical procedures to remove the impacted tooth and review of patient on Day 1 and Day 7 after surgery. Prior to the surgical procedure, dental panoramic tomograph was taken for every patient who participated in the study for classification of impaction according to Winter's classification and to exclude any other pathologies.

Ethical approval was granted from the USIM dental research team prior to the study (USIM/Fpg-MEC/2014/No.03).

Inclusion criteria of the samples were: (1) Healthy patient or patient with mild systemic disease only according to American Society of Anaesthesiologists (ASA) Physical Status Classification System (Table 1). Only patient with ASA I and ASA II were accepted. (2) Patient whose impacted wisdom tooth are indicated for surgical removal (NICE, 2000). (3) Patient who agreed to have treatment carried out under local anesthesia. (4) Patient is not allergic to any of the medication that would be used/ prescribed in the study. (5) Patient does not take any antibiotic or anti-inflammatory medication in 7 days prior to the surgery.

Table 1 ASA Physical Status (ASA PS) Classification System

ASA PS Classification	Definition
ASA I	A normal healthy patient
ASA II	A patient with mild systemic disease
ASA III	A patient with severe systemic disease
ASA IV	A patient with severe systemic disease that is a constant threat to life
ASA V	A moribund patient who is not expected to survive without the operation
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes

The exclusion criteria were: (1) Patient with ASA PS Classification above II. (2) Impacted teeth that were indicated for removal under general anesthesia. (3) Patient who presents with acute infection at the operating site 7 days prior to surgery. (4) Patient who was not able to give voluntarily consent.

A total of 23 patients were randomly divided into 3 groups (A, B and C). Patients in group A was treated with normal saline as an irrigant, distilled water was used in group B and chlorhexidine gluconate 0.12% (Periogard, Colgate-Palmolive, New York) was used in Group C. Written consents for both the study and surgery were taken from all the patients prior to surgery. All patients were treated with the same surgical

technique. The irrigating solution was delivered as continuous stream during the surgery via low speed handpiece.

After removal of the wisdom tooth, the socket was cleaned and rinsed with the respective irrigating solutions before Dafilon suture (B.Braun, Malaysia) was applied. Patient was given standard post-operative instructions after the surgery and asked to stop smoking for 1 week. Etoricoxib (Arcoxia 90 mg tablet, od x 3) (Merck Sharp & Dohme, New Zealand) and Paracetamol (Paracetamol 1 g tablet, tds x 10) (Pharmaniaga, Malaysia) were given as post-operative medication.

All the patients were reviewed on Day 1 and Day 7 post-operatively for complications in terms of pain, swelling, infection and delayed wound healing. Intensity of pain is measured by using Visual Analogue Scale (VAS) (McCormack *et al.*, 1988) whereby the intensity of pain is divided into 10 scales with 0 indicates no pain at all and 10 as the most severe pain that the patient has ever suffered. Swelling was assessed clinically by its presence and infection was measured through systemic effects such as fever, sore throat or lymphadenopathy. Delayed wound healing was judged by whether there was any wound dehiscence. Suture removal was completed 7 days after the surgery.

Statistical analysis by ANOVA and Fisher's exact test were carried out. *P* value of less than 0.05 was considered significant. The null hypothesis of the present study was there would be no statistically significant difference in post-operative clinical complications among the 3 different types of irrigating solutions used in the study.

Results

A total of 23 patients, 11 (48%) females and 12 (52%) males, with mean age of 25.8 (the youngest at 19 and oldest at 46) took part in the study. Fourteen of the patients had requested for wisdom tooth removal due to recurrent pericoronitis; whereas the other 7 were due to unrestorable caries and 2 patients have it removed due to untreatable pulpal and/or periapical pathology. With regards to types of impaction, 11 (48%) patients presented with mesioangular impaction, 8 have vertical impaction, the remaining 4 presented with horizontal impaction (Table 2). All patients have moderate to good oral hygiene. All the samples presented with swelling on Day 1 after operation (Table 3). However, only two patients continued to have swelling on Day 7 after operation (Table 4).

Decreased of pain on postoperative Day 7 is seen in all cases except 2 cases that presented with increased of pain score. Only one case presented with postoperative infection but there is none for delayed wound healing. No statistically significant ($p<0.05$) post-operative complications found between the groups (Table 5).

Discussion

Pain and swelling are the patients' chief complaints and become the main concern to clinicians after surgical removal of impacted lower wisdom tooth. Any measure that can lessen or eliminate these 2 problems would be of good news to both parties. Irrigating during surgical removal of impacted lower wisdom tooth has been a standard practice. It helps clinician to have a better view of surgical site by removing blood, bony debris and foreign bodies. At the same time, it also reduces heating effects from the rotating instrument that used to cut the bone and bacterial load at the surgical site which contributes to a more promising healing (Kumar *et al*., 2011).

An ideal irrigating solution for surgical removal of wisdom tooth should be easily available or prepared, isotonic, nonirritant, nontoxic, non-hemolytic, antiseptic and yet economic (Urvi *et al*., 2014).

In the present study, the efficacy of normal saline, chlorhexidine and distilled water as irrigating solution during the surgical removal of impacted lower wisdom tooth was studied. Normal saline has physiologic properties and is always safe as irrigating solution. It is also isotonic and therefore chemically more similar to the natural tissue fluid compared to the other solution. It is the most widely used irrigating solution for surgical removal of wisdom tooth. On the other hand, chlorhexidine is a

known antiseptic and has been shown to be safe and effective in different intraoral procedures (Larsen, 1991; Yamalik *et al*., 1992; Kosutic *et al*., 2009). It is bactericidal against both Gram-positive and Gram-negative bacteria by disrupting the cell membrane of microorganism. In addition, it is also biocide against fungi. Moreover, chlorhexidine acts rapidly and its action is not affected by the presence of body fluids such as blood (Denton, 2001). On top of these, chlorhexidine has the advantage of residual effect or substantivity over 48 hours (Denton, 2001). This allows for a longer duration of antimicrobial action.

Distilled water is the water that has gone through various filtration processes to remove the contaminants. It is neither bacteriostatic nor bactericidal and does not have added buffer. However, it is safe to use and easily available in the dental school. The only drawback of distilled water as irrigating solution is it is hypotonic and can cause cell lysis especially on erythrocytes over a period of contact (van den Tillaart *et al*., 2009). However, in the context of surgical removal of wisdom tooth, it only has a very short period of contact with the tissue as it is almost instantly being removed by suction.

Additionally, cost has become an increasingly important factor in the clinical decision making and is even more so in a dental school where there is only limited budget. However, cost reduction should not jeopardise patients' health status. A bottle of 500 ml of normal saline is RM6.00 (RM 0.012/ml) and has to be discarded after 24 hours it was opened as bacterial growth may be present within that period. Although the cost of normal saline is not expensive per unit, it could become a significant expenditure when a large number of patients are treated for removal of impacted wisdom tooth in a dental school. On the other hand, a bottle of 300ml chlorhexidine gluconate mouthwash 0.12% costs RM14.50 (RM 0.048/ml). This is the main drawback of using chlorhexidine as irrigating solution during the surgical removal of impacted wisdom tooth. Literature review reveals that the use of antiseptic solution might compromise the healing process of wound (Brennan and Leaper, 1985; Bergstrom *et al*., 1994; Thomas *et al*., 2009; Queiros *et al* 2013). This could be another reason why chlorhexidine is not being used frequently as irrigating solution in the surgical removal of impacted wisdom tooth. In comparison, the cost of distilled water is RM0.50 per m^3 (RM 0.0000005/ml). In the dental school, distilled water is always processed locally for the usage of autoclave and dental unit.

Previous studies had compared the effects between betadine with normal saline and chlorhexidine with betadine as irrigating solutions for surgical removal of wisdom tooth (Yaghmaee *et al*., 2006; Urvi *et al*., 2014). Both studies show no significant difference in terms of postoperative complication and healing process between the two groups. However, Urvi *et al* (2014) found that chlorhexidine was more effective than povidone iodine in terms of controlling the postoperative pain and alveolar osteitis although the size of sample in the study was relatively small (20) to give a firm conclusion.

In the present study, 2 patients scored higher scale of pain on Day 7 compared to Day 1. From these 2 patients, one had missing a suture on Day 1 review and developed dry socket on Day 7 review; whereas the other has a horizontal impaction of wisdom tooth and this might contributed to difficult exodontia. These probably contributed to the higher pain score.

The present study also show two subjects, one each from normal saline and chlorhexidine groups developed alveolar osteitis. This could be due to prolonged and difficult surgery as both cases are horizontally impacted, or patient failed to follow post-operative instruction. Literature does not support the relationship of alveolar osteitis and type of irrigating solution (Tolstunov, 2012; Eshghpour and Nejat, 2013; Urvi *et al*, 2014).

Conclusion

Within the limitation of the present study, it is concluded that there was no significant difference between the three irrigating solution that were used in the surgical removal of impacted lower wisdom tooth in terms of postoperative complication. A bigger scale of research with more samples is recommended to evaluate the most efficacy irrigating solution during surgical removal of impacted lower wisdom tooth.

Table 2 Types of wisdom tooth impactions

Type of Impactions	Mesioangular	Horizontal	Vertical	Total sample
Number of sample	**11**	**4**	**8**	**23**

Table 3 Day 1 Post-operative clinical complication of surgical removal of lower wisdom tooth

	Post-operative clinical complication, Day 1					
	Pain	**Swelling**	**Fever**	**Sore Throat**	**Lymphadenopathy**	**Wound Dehiscence**
Number of sample	17(Grade 0-4), 4 (Grade 4-7), 1 (Grade 8-10)	23	-	-	-	-

Table 4 Day 7 Post-operative clinical complication of surgical removal of lower wisdom tooth

	Post-operative clinical complication, Day 7					
	Pain	**Swelling**	**Fever**	**Sore Throat**	**Lymphadenopathy**	**Wound Dehiscence**
Number of sample	21(Grade 0-4), 2 (Grade 4-7),	2	-	1	-	2

Table 5 ANOVA for the post-operative complications on Day 1 and Day 7

Day 1	***df***	**Sum of Squares**	**Mean Square**	***F***	***p***
Between Groups	2	8.05	4.03	1.17	0.33
Within Groups	21	72.44	3.45		
Total	23	80.50			

Day 2	***df***	**Sum of Squares**	**Mean Square**	***F***	***p***
Between Groups	2	0.20	0.10	0.03	0.97
Within Groups	21	77.76	3.70		
Total	23	77.96			

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