IBOM MEDICAL JOURNAL
Vol.14 No.3 July, 2021. Pages 336 - 342
www.ibommedicaljournal.org

A randomized comparative study of warm saline mouth rinse protocols for prevention of Alveolar Osteitis following dental extractions

Olaniyi Henry Olaitan[1], Esezobor Peter Egbor[2], Osagie Akpata[3]

[1,2,3]Department of Oral and Maxillofacial Surgery, University of Benin Teaching Hospital, Benin City, Edo State, Nigeria.

Abstract

Background: Warm saline mouth rinse (WSMR) for the prevention of alveolar osteitis (AO) following tooth extraction has been proven to be beneficial. The current practice of patients performing WSMR for 6-8 times a day for one week is cumbersome especially for patients in the working class.
Objective: This study was conducted to determine the effect of different WSMR regimes (frequency and duration) on incidence of AO in patients who had intra-alveolar extraction. Methods: There were 253 participants with mean age of 29.3±8.4 years. They were randomly divided into four groups. Group1 had WSMR six times daily for 7 days; group 2, twice daily for 7 days; group 3, six times daily for 3 days, and group 4, twice daily for 3 days. Subjects were reviewed on the 3rd and 7th day post extraction.
Results: The overall incidence of AO was 4.3%. Incidence of AO among group 1,2,3, and 4 were 4.8%, 3.2%, 4.8%, and 4.6% respectively. Occurrence of AO was not statistically significantly affected by either frequency or duration of WSMR ($p > 0.05$).
Conclusions: We recommend WSMR twice daily as prophylactic measure for AO to allow for patient convenience and increase compliance.

Key words: tooth extraction, alveolar osteitis, warm saline mouth rinse, frequency, duration.

Introduction

Alveolar Osteitis (AO) is a postoperative pain in and around the extraction site that increases in severity at any time commonly between the first and the third day after a dental extraction, accompanied by partially or totally disintegrated blood clot within the alveolar socket with or without halitosis.[1]
Studies from Nigeria show that incidence of AO following routine dental extraction range from 4.1% to 8.2%.[2,3] Although the exact etiology has not been identified, several theories have been proposed to explain this phenomenon. The widely accepted fibrinolytic theory proposed by Birn states that the release of tissue factors from trauma or pre-existing infection leads to the conversion of plasminogen to plasmin (which lyses blood clot) resulting in AO.[4]
Several risk factors for developing AO have been identified such as traumatic extraction, presence of pre-existing infection, female gender (use of contraceptive and stage of the menstrual cycle), smoking, and poor oral hygiene.[5]
Given the significant pain and delayed healing associated with AO, several prophylactic measures have been adopted to prevent its occurrence and these include the use of anti-fibrinolytic agents, antibacterial agents, and clot support agents.[6]
Antiseptics agents such as chlorhexidine are used in the preoperative and postoperative phases of tooth extraction to reduce the bacteria load in the oral cavity that is thought to contribute to fibrinolysis and loss of clot in the socket.[1,6]
Globally, post-extraction instructions usually involve the use of commercial antiseptic mouthwashes. However, in Nigeria and other low-

Corresponding Author: Dr. Esezobor Peter Egbor

Department of Oral and Maxillofacial Surgery,
University of Benin Teaching Hospital,
Benin City, Edo State, Nigeria.
E-mail: peter.egbor@uniben.edu, Phone: +2348052121100

income developing countries, warm saline is usually preferred possibly due to its ready availability and minimal cost to the patient.[7,8] The warm saline rinse is prepared by dissolving one levelled teaspoon of salt in a glass of warm water (300–350ml), thus producing a hypertonic solution that is believed to be bacteriostatic.[9]

WSMR for the prevention of AO following tooth extraction has been proven to be beneficial and compares favourably with chlorhexidine.[10] Although the mechanism of action of warm saline rinse is not completely understood, its proven efficacy may be explained in terms of the hypertonic nature of the solution which is believed to inhibit bacteria activity but encourage the growth of oral commensal microorganisms. This bacteriostatic effect occurs when the bacterial intracellular fluid is drawn out through the bacterial cell wall, which acts as a semipermeable membrane, by the relatively more concentrated hypertonic saline solution in a process called plasmolysis. The thermal effect of the warm saline rinse also encourages smooth and uncomplicated healing by inducing vasodilatation of the vasculature of the oral cavity, and thus enhances the migration of phagocytes to the extraction site.[9,10]

In many dental clinics in Nigeria, patients are usually instructed to gently rinse with warm saline six times daily for a week starting from 24 hours post-extraction.[11] Strict adherence to this post-extraction protocol may not be feasible for some patients, as patients are expected to rinse before and after every meal irrespective of the patient's profession or social activities.

The current practice of patients performing WSMR six times a day for one week[10] is cumbersome especially for patients in the working class. Findings from a recent study carried out in the Southern part of Nigeria[12] show that less than 50% of subjects who were instructed to carry out WSMR eight times daily for a period of one week following tooth extraction complied with the instruction. Therefore, there is a need to develop an evidence-based protocol that will be both efficacious in preventing AO and other socket healing complications as well as aid patient compliance.

Osunde et al.[10] in a study done in Calabar found no significant difference with respect to the incidence of AO and other socket healing complications between subjects who carried out WSMR twice daily for one week following routine dental extraction and those who did it six times daily for one week. However, all subjects in that particular study received systemic antibiotics post-extraction which could have confounded the efficacy or otherwise of WSMR instituted. Furthermore, studies have shown that the use of antibiotics post-extraction is not advocated due to the development of resistance.[13,14]

With respect to duration of WSMR, a duration of one week might not be necessary considering the fact that AO as defined by Blum[1] usually occurs within the first 72 hours following tooth extraction. Moreover, by the third day post-extraction, the inflammatory phase of wound healing has commenced and fibroblasts have begun to arrive at the post-extraction wound site.[15] The question thus arises about the minimum frequency and duration that will achieve the maximum benefit of WSMR therapy.

Although some studies[10,11] demonstrate that WSMB is beneficial, the effects of frequency and duration of warm saline mouth rinse (WSMR) on the incidence of AO have not been reported to the best of our knowledge. This study, therefore, aims at providing an evidenced-based protocol on the frequency and duration of warm saline mouth rinse after dental extractions.

Patients and Methods

This was a randomized single-blind comparative study that involved 264 patients indicated for intra-alveolar extraction. Ethical approval was obtained from the hospital's ethics and research committee (ADM/E22/A/VOL. VII/1263). The duration of the study was twelve months.

Inclusion criteria were (1) patients (male and female) indicated for intra-alveolar extractions of a single tooth (premolars or molars) in the lower arch; (2) patients aged 18-50 years; (3) females with a regular 28-day menstrual cycle. Exclusion criteria were (1) Participants with any known systemic disease that compromised the immune system; (2) acute suppurative odontogenic infection; (3) current antibiotic or hormonal contraceptives use, (4) smoker; (5) simplified oral hygiene index total score[16] greater than 3.0; (5) extraction procedure lasting more than 10 minutes from the onset of local

anaesthesia.
The information obtained includes bio-data (age, gender, tribe, the highest level of education and occupation), indication for tooth extraction, detailed medical history to rule out the presence of any debilitating systemic disease that could compromise the immune system, and a detailed drug history.

Extraction and Randomization of participants
All extractions were carried out by the first and second authors. The extractions were done under local anaesthesia (1.8ml of 2% lidocaine with adrenaline 1:100,000), and strict aseptic technique. Hemostasis was achieved utilizing sterile gauze packs. Only one vial (1.8mls) of local anaesthetic was allowed per subject. After the extraction, the subjects were randomly allotted into four groups using a computer-generated randomization table.

Warm saline mouth rinse protocol
The different WSMR protocols were commenced at 24 hours post-extraction for the four groups of participants.
Group 1: WSMR six times daily (before and after every meal) for 7 days. Group 2: WSMR twice daily (after breakfast and at bedtime) for 7 days. Group 3: WSMR six times daily (before and after every meal) for 3 days. Group 4: WSMR twice daily (after breakfast and at bedtime) for 3 days.
Compliance was ensured by giving subjects copies of printed materials on post-extraction instructions to take home in addition to verbal instructions. The participants were placed on 1gram of oral paracetamol 8 hourly for 24 hours. No antibiotics was prescribed for the patients as studied have shown that antibiotics are not required for routine extractions.[17,18] All patients were told to report to the clinic in the event of intolerable pain.

Post-operative data collection
The clinical assessment of the extraction socket was done on the 3rd and 7th day post-extraction. The assessment was carried out by the first author who was blinded to the group the patient was allotted to. The post-extraction socket was visually inspected for signs of inflammation, partial or total clot disintegration, and alveolar bone exposure. The visual analogue scale (VAS) was used for pain assessment. The pain level as measured with the VAS by the patient was recorded. Furthermore, organoleptic measurement of halitosis was done by requesting the patients to take a deep breath through the nostrils and hold for a while. The patient was to subsequently expire through the mouth while the examiner sniffed the odour at a distance of 20cm. The severity of the odour was classified on a 5-point scale (0: no odour, 1: barely noticeable, 2: slight but clearly noticeable, 3: moderate, 4: strong, and 5: extremely strong).[19,20]
The diagnosis of dry socket was made in a patient with persistent or increased post-operative pain in and around the extraction socket not adequately relieved by mild analgesics (oral paracetamol), accompanied by a partially or totally disintegrated blood clot or an empty socket with or without halitosis.[1,2]

Data Analysis
Statistical analyses were done with IBM SPSS Version 21.0 software. Descriptive statistics were performed on the data. Comparison of categorical variables was done using the Chi-square test. The level of significance was set at $p < 0.05$.

Results
A total of 253 of the 264 patients recruited within the period of study completed the study. Eleven patients failed to comply with post-operative WSMR protocol and were excluded from the analysis. The mean age of the study participants was 29.3±8.4 years with an age range of 18-50 years. One hundred and twenty-nine (51%) males and one hundred and twenty-four (49%) females participated in the study. The majority (53.8%) of the study participants had a tertiary level of education. Two hundred and fifty-three teeth were extracted and the majority (89.7%) of the extracted teeth were molars (Table 1).
Table 2 shows that the overall incidence of alveolar osteitis was 4.3% with group 1 and 3 cohorts recording the highest incidence rate of 4.8% each. There was however no significant difference between the groups ($p = 0.960$). The majority of the patients (36.4%) developed AO on the second-day post-extraction. No case of AO was recorded on the first-day post-extraction (Table 3). There was no statistically significant association between the demographic and clinical parameters on the

Table 1. Demographic and clinical characteristics of participants

Sociodemographic characteristics	Group 1 n (%)	Group 2 n (%)	Group 3 n (%)	Group 4 n (%)	Total n (%)	χ^2	p-value
Age group (years)						6.10	0.412
18-28	32(51.6)	40(63.5)	34(54.0)	36(55.4)	142(56.1)		
29-39	17(27.4)	14(22.2)	22(34.9)	22(33.8)	75(29.7)		
40-50	13(21.0)	9(14.3)	7(11.1)	7(10.8)	36(14.2)		
Sex						2.05	0.563
Male	30(48.4)	37(58.7)	30(47.6)	32(49.2)	129(51.0)		
Female	32(51.6)	26(41.3)	33(52.4)	33(50.8)	124(49.0)		
Education level						2.58	0.859
Primary	2(3.2)	3(4.8)	2(3.2)	4(6.2)	11(4.3)		
Secondary	27(43.5)	30(47.6)	25(39.7)	24(36.9)	106(41.9)		
Tertiary	33(53.2)	30(47.6)	36(57.1)	37(56.9)	136(53.8)		
Tooth extracted						4.89	0.844
Mand. Premolars	6 (9.8)	7 (11.1)	6 (9.5)	9 (13.8)	28 (11.1)		
Mand. Molars	56 (90.2)	56 (88.9)	57 (90.5)	56 (86.2)	225 (88.9)		

Table 2. Incidence of alveolar osteitis within the study groups

Alveolar Osteitis	Present n (%)	Absent n (%)	Total n (%)	χ^2	*p-value
Group 1 (6x7days)	3 (4.8)	59 (95.2)	62 (100.0)	0.281	0.960
Group 2 (2x7days)	2 (3.2)	61 (96.8)	63 (100.0)		
Group 3 (6x3days)	3 (4.8)	60 (95.2)	63 (100.0)		
Group 4 (2x3days)	3 (4.6)	62 (95.4)	65 (100.0)		
Total	11 (4.3)	242 (95.7)	253 (100.0)		

Table 3. Time of onset of Alveolitis Osteitis

Day of onset Post-extraction	n (%)	VAS Mean ± SD	Halitosis score Mean ± SD
1	0 (0.0)	0.00 ± 0.00	0.00 ± 0.00
2	4 (36.4)	8.00 ± 0.82	0.75 ± 0.96
3	3 (27.3)	7.67 ± 0.58	1.67 ± 1.15
4	3 (27.3)	6.56 ± 1.53	0.67 ± 1.15
5	1 (36.4)	8.00 ± 0.00	3.00 ± 0.00

Table 4. Association between sociodemographic, clinical parameters and alveolar osteitis

Variable	n=253	Alveolar osteitis		χ^2	*P-value
		Present (%)	Absent (%)		
Age group (years)				0.351	0.839
18-28	142	7 (4.9)	135 (95.1)		
29-39	75	3 (4.0)	72 (96.0)		
40-50	36	1 (2.8)	32 (97.2)		
Sex				0.141	0.707
Male	129	5 (3.9)	124 (96.1)		
Female	124	6 (4.8)	118 (95.2)		
Education level				5.740	0.056
Primary	11	2 (18.2)	9 (81.8)		
Secondary	106	5 (4.7)	101(95.3)		
Tertiary	136	4 (2.9)	132 (97.1)		
Tooth extracted				0.140	0.708
Mand. premolars	26	4 (15.4)	22 (84.6)		
Mand. molars	227	29 (12.8)	198(87.2)		

Table 5. Comparing effect of varying frequencies and duration of WSMR on the incidence of alveolar osteitis

Variable	n	Present n (%)	Absent n (%)	χ^2	P-value
Frequency of WSMR					
6 times daily	125	6 (4.8)	119 (95.2)	0.121	0.727
2 times daily	128	5 (3.9)	123 (96.1)		
Duration of WSMR					
Seven days	125	5 (4.0)	120 (96.0)	0.071	0.788
Three days	128	6 (4.7)	122 (95.3)		

incidence of developing alveolar osteitis among the study participants (Table 4).

Table 5 shows the effect of frequency and duration of WSMR on the incidence of AO. Comparing the two different protocols concerning the frequency of WSMR (6 times daily and 2 times daily) following tooth extraction, there were more cases of reported AO in subjects who did WSMR six times daily. This was however not statistically significant (p=0.727). Comparing the duration of WSMR (7 days duration and 3 days duration) following a tooth extraction, no statistical difference was seen although the incidence of AO was lower in the cohort who did WSMR for 7 days duration (p =0.071).

Discussion

Alveolar socket irrigation after extraction is a common postoperative instruction given to patients. The overall incidence rate for AO found in this study was 4.3% and this is comparable to the findings of previous studies. This is comparable to the reported global incidence of AO for routine extraction that ranges from 0.5% - 5%.[21,22] and to previous studies in Nigeria that reported an incidence rate of 4.1% - 8.2%.[2,3] However, our finding is lower than the 13.2% incidence rate reported by Akpata et al[7] in an

earlier study conducted in the same institution. This difference in findings could be ascribed to the criteria set in this present study for diagnosing AO and distinguishing AO from acute infected socket and acute inflamed socket.

This study investigated the possible effect of varying frequencies and duration of WSMR protocols for the prevention of AO following tooth extraction. In comparing twice daily and six times daily WSMR on the incidence of AO, this study recorded a lower incidence of AO (3.9%) in patients who did WSMR twice daily irrespective of the duration. However statistical analysis did not reveal any significant difference between the subjects who did WSMR twice daily and those who did it six times daily. Osunde et al. in a study investigating the effect of WSMR on post-extraction complications reported similar findings.[12] The 6-8 times rinse with warm saline has been a time-honoured practice. However, the inconvenience it causes for the patients because of the busy nature of the present-day society makes for difficult compliance. This non-compliance can provoke total abandonment of the postoperative instructions in its entirety.

Assessing for the effect of duration of WSMR on the occurrence of AO, the incidence of AO was marginally lower in subjects who performed WSMR for 7 days (4.0%) when compared to those who did for only 3 days (4.7%). This is in agreement with a previous study12 and could be to the possibility of developing AO even after day 3 post-extraction as evidenced by findings from this present study. However, the difference observed between WSMR for 7 days and WSMR for 3 days in this study was not statically significant.

Our study supports the findings in the literature that the commonest time of onset for AO is within the first 72 hours. Thus, post-extraction prophylaxis such as WSMR should aim at maximum effect within this critical time frame.

WSMR not only helps to maintain good oral hygiene but has also been shown to help prevent the development or reduce the incidence of AO.[23,24] as corroborated by the findings of the present study. The use of chlorhexidine mouth rinse pre- and post-extraction is commonplace in developed climes. However, with the poor implementation of the health insurance scheme and its limited coverage in Nigeria, most patients result to out-of-pocket payments to meet their health obligations. With the results of studies that have shown that WSMR is equally as effective as chlorhexidine mouth rinse as prophylaxis for the prevention of AO,[8,25] the use of WSMR becomes a readily viable alternative.

In conclusion, we recommend WSMR twice daily as a prophylactic measure for Alveolar Osteitis to allow for patient convenience and increase compliance. However, the duration of WSMR should be for 7 days, due to the possibility of developing Alveolar Osteitis even up to day 5 post-extraction as observed in this study.

Funding
None

Competing interest
None

Ethical approval
Ethics and Research Committee, University of Benin Teaching Hospital (ADM/E22/A/VOL. VII/1263).

References

1. Blum IR. Contemporary views on dry alveolus (alveolar osteitis): A clinical appraisal of standardization, aetiopathogenesis and management: A critical review. lnt J Oral Maxillofac Surg 2002; 31:309-317
2. Adeyemo WL, Ladeinde AL, Ogunlewe MO. Clinical Evaluation of Post-extraction site wound Healing. J Contemp Dent Pract 2006; (7) 3:040-049.
3. Oginni FO, Fatusi OA, Alagbe AO. A clinical evaluation of dry socket in a Nigerian teaching hospital. J Oral Maxillofac Surg 2003; 61:871-876.
4. Birn H. Etiology and pathogenesis of fibrinolytic alveolitis (dry socket). Int J Oral Surg 1973; 2:215-263.
5. Ogunlewe MO, Adeyemo WL, Ladeinde AL, Taiwo OA. Incidence and pattern of presentation of dry socket following non-surgical tooth extraction. Nig. Q.J Hosp Med 2007;17:126-130.
6. Caso A, Hung LK, Beirne OR. Prevention of alveolar osteitis with chlorhexidine: a me-ta-

analytic review. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2005;99(2):155-159.
7. Akpata O, Omoregie FO, Owotade F. Alveolar Osteitis: Patients' compliance to post-extraction instructions following extraction of molar teeth. Niger Med J. 2013; 54(5): 335–338.
8. Naik C, Dany SS, Satpathy AK. Efficacy of Warm Saline and Chlorhexidine Mouth Rinses in the Prevention of Alveolar Osteitis after Third Molar Surgery: A Comparative Study. Int J Oral Care Res. 2017;5(4):270-273.
9. Larsen PE. Alveolar osteitis after surgical removal of impacted mandibular third molars. Identification of the patient at risk. Oral Surg Oral Med Oral Pathol. 1992;73(4):393-397.
10. Osunde OD, Adebola RA, Adeoye JB, Bassey GO. Comparative study of the effect of warm saline mouth rinse on complications after dental extractions. Int J Oral Maxillofac Surg. 2014; 43: 649–653.
11. Akinbami BO, Godspower T. Dry Socket: Incidence, Clinical features, and predisposing factors. International Journal of Dentistry 2014; 2014:796102.
12. Osunde OD, Bassey GO, Anyanechi CE. Warm saline mouth rinse instructions after dental extractions: How well do patients comply? Journal of Medicine in the Tropics 2016; 18:1:33-37
13. Deepa M, Mony D, Ratra T. Prophylactic antibiotics after extraction: Needed or not needed? J Int Oral Health 2017; 9: 265 – 268.
14. Oomens MA, Forouzanfar T. Antibiotic prophylaxis in third molar surgery: a review. Oral Surg Oral Med Oral Pathol Oral Radiol 2012;114: e5–e12.
15. Raymond JF. Oral and Maxillofacial Trauma. 4th edition.2013. Elsevier Saunders. Missouri. ISBN: 978-1-4557-0554-2.
16. Greene JC, Vermillion JR. The Simplified Oral Hygiene Index. J Am Dent Assoc. 1964; 68:7-13.
17. Yousuf W, Khan M, Mehdi H, Mateen S. Necessity of Antibiotics following Simple Exodontia. Scientifica. 2016; doi 10.1155/2016/2932697.
18. Sidana S, Mistry Y, Gandevivala A, Motwani N. Evaluation of the need for antibiotic prophylaxis during routine intra-alveolar dental extractions in healthy patients: a randomized double-blind controlled trial. J Evid Base Dent Pract 2017; 17(3); 184-189.
19. Yaegaki K, Coil JM. Examination, classification and treatment of halitosis: clinical perspectives. J Can Dent Assoc 2000; 66:257-61.
20. De Boever EH, De Uzeda M, Loesche WJ. Relationship between volatile sulphur compound, BANA-hydrolyzing bacteria and gingival health in patients with and without complaints of oral malodour. The Journal of Clinical Dentistry. 1994; 4:114-119.
21. Cardoso CL, Rodriguez MT V, Junior OF, Garlet GP, Perri de Carvalho PS. Clinical Concepts of dry socket. J Oral Maxillofacial Surg. 2010; 68: 1922-1932.
22. Kolokythas, A., Olech, E., Miloro, M. Alveolar osteitis: a comprehensive review of concepts and controversies. International Journal of Dentistry 2010; 2010:249073.
23. Benediktsdottir IE, Wenzel A, Petersen JK, Hintze H. Mandibular third molar removal: risk indicators for extended operation time, postoperative pain and complications. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2004; 79:434–46.
24. Jerjes W, El-Maaytah M, Swinson B, Banu B, Upile T, D'Sa S, Al-Khawalde M, Chaib B, Hopper C. Experience versus complication rate in third molar surgery. Head Face Med 2006; 2:14.
25. Berwick JE, Lessin ME: Effects of a chlorhexidine gluconate oral rinse on the incidence of alveolar osteitis in mandibular third molar surgery. J Oral Maxillofac Surg 1990; 48:444-448.