

ALVEOLAR OSTEITIS: INCIDENCE AND RISK FACTORS FOLLOWING THIRD MOLAR SURGERY IN JORDAN

ABEDALWAHAB A. ALWRAIKAT, BDS, MSc

ABSTRACT

The purpose of this study was to evaluate the incidence and risk factors contributing to the development of alveolar osteitis (dry socket).

The records of 1087 patients who underwent removal of third molar teeth at the Oral and Maxillofacial Department of King Hussein Medical Center, Royal Medical Services between January, 1999 to December, 2008 were prospectively collected and analyzed to evaluate the incidence of alveolar osteitis (dry socket) and possible risk factors. Data were analyzed using SPSS version 17.0 (SPSS Inc, Chicago, IL) with simple descriptive statistics and the X^2 test, as appropriate. $P < .05$ was considered significant.

Out of 1087 operated patients, 586 were females (53.9%) and 501 were males (46.1%). The incidence of alveolar osteitis was observed in 138 patients (12.7%), out of these 50 were males (4.6%) and 88 were females (8.1%). The difference was found to be statistically significant ($p < 0.05$). 115 out of the 857 patients (13.4%) partially impacted third molars showed greatest incidence of alveolar osteitis (dry socket). Regarding level of impaction, the difference was not significant. 54 patients out of 208 smokers returned with alveolar osteitis. The difference of incidence of alveolar osteitis between smokers and non smokers was statistically significant ($p < 0.05$), whereas the incidence was higher in patients who were operated by junior surgeons. The difference between the two groups was statistically significant ($p < 0.05$). But, no relationship could be established with the age factor, time of surgery and administration of contraceptives.

Key words: Alveolar osteitis, third molar surgery, level of impactions

INTRODUCTION AND LITERATURE REVIEW

Alveolar Osteitis (dry socket) is the most common complication following a tooth extraction in Jordan especially the removal of the mandibular third molar tooth. It is usually characterized by increasingly severe pain in and around the extraction site, often starting on the third to fifth postoperative day. "Dry socket" as a term was first used by Crawford in 1896, since that time, other terms have been used to describe dry socket: alveolar osteitis (AO), fibrinolytic alveolitis, alveolitis sicca dolorosa, postoperative alveolitis, alveolgia, septic socket, necrotic socket, localized osteomyelitis, fibrinolytic alveolitis, and delayed extraction wound healing.^{1,2}

The normal post-extraction blood clot is absent from the tooth socket(s), the bony walls of which are denuded and highly sensitive to even gentle probing, halitosis is invariably present.³ The condition probably arises as a result of a complex interaction between surgical trauma, local bacterial infection and various systemic factors.³⁻⁷ Other factors that may play role in the development of the alveolar osteitis are the intraoperative complications (root fracture, alveolar bone fracture), it has been suggested that possible remaining fragments from the tooth and alveolar bone may be an additional cause of the alveolar osteitis.⁸ The increase of fibrinolytic activity within the socket and the

interaction of many other factors have been also reported.^{9,10}

There is great variation in reported incidence rates (0.5%-68.4%) between series, usually due to inconsistency in diagnostic criteria, variation in microbial prophylaxis, patient medical status and the operative skills of the surgeons.¹¹⁻¹⁷ The true incidence rate probably lies somewhere between 5% and 20%.^{8,12,18,19} There is no strong evidence that the development of alveolar osteitis is related to the gender, although there are some reports in the literature showing higher incidence of alveolar osteitis among females.^{5,19} The indications of third mandibular molars removal are associated with the subsequent development of alveolar osteitis. Patients who had their teeth removed for therapeutic reasons (caries, infection, cystic lesions and others) are more likely to develop alveolar osteitis than patients underwent prophylactic (for orthodontic, prosthetic indications) removal of their third molar teeth.^{12,30}

Smoking is strongly related to some of the post-extraction complications, among them the alveolar osteitis. Some authors report that smokers have 2 to 5 times the risk of non-smokers for developing alveolar osteitis.^{20,21} Oral contraceptive use in females has also been reported to increase the risk of alveolar osteitis by two to three folds, when compared to males.^{15,27} How-

Correspondence: Dr Abedalwahhab A Alwraikat, Senior, Specialist Oral and Maxillofacial Surgery, King Hussein Medical Center, Royal Medical Services, Abu-Nsair P.O.Box (542201), Z.C 11937, Amman – Jordan. Mobile: +962 777 743 733, E-mail: aalwraikat@yahoo.com

ever, other studies have reported the incidence of alveolar osteitis between females using oral contraceptives and those not using oral contraceptives to be similar.

The incidence of alveolar osteitis has been reduced to the level of 2% to 8% by the application of several medications like chlorhexidine mouth rinse²⁴, metronidazole²⁸, fibrinolytic agents²², clindamycin and tetracycline^{29,30}, local antiseptic packs³¹ and others.²³

In this study we tried to find out the incidence and risk factors contributing in the development of alveolar osteitis.

METHODOLOGY

The records of 1087 patients underwent removal of third molar teeth which performed at the Oral and Maxillofacial Department of King Hussein Medical Center, Royal Medical Services between January, 1999 and December, 2008, were prospectively collected and analyzed for the incidence of Alveolar osteitis (Dry Socket). Only the records of fit and healthy patients were considered for this study, patients taking medications for chronic diseases were excluded. All the patients were distributed randomly between junior and senior oral and maxillofacial surgeons.

Several variables were collected from the records: Age, gender, degree and type of impaction, duration of the operation, surgical experience of the surgeon, smoking, the indication of teeth removal (prophylactic or therapeutic), oral contraceptives.

The techniques of the removal, the instruments and the postoperative regimes were standardized for all patients. All patients were given the opportunity to know all the complications of the removal of the third molar teeth and signed a written consent form. The local anesthetic given to all patients was Xylocaine with adrenaline 1:80 000 and not more than five cartridges were given to a single patient.

For the removal of teeth, the following methodology was used: All teeth were approached first by simple technique where a forceps or elevator was used to remove the tooth, in cases of impacted teeth, an envelop mucoperiosteal flap was raised and the possible bone overlying the tooth was removed using a slow speed round bur. In some cases it was mandatory to use a straight fissure bur to section the crown or the roots to enhance the removal of tooth atraumatically. A sterile normal saline irrigation was used during the tooth sectioning and bone removal. After removal of teeth, the wounds were vigorously irrigated and possible sharp areas smoothed with bone file. A 3-0 Vicryl was used to close the wounds.

The postoperative regimen was standardized for all patients. It included the following: A written instruction sheet about possible complications and how to overcome them. 400 mg of oral Metronidazole twice a day for 5 days, Ibuprofen 400mg every 8 hours for 5 days.

Data were analyzed using SPSS version 11.0 (SPSS Inc, Chicago, IL) with simple descriptive statistics and the χ^2 test, as appropriate. $P < .05$ was considered significant.

RESULTS

A total number of 1087 patients were operated, 586 were females (53.9%) and 501 were males (46.1%). The overall incidence of alveolar osteitis was 12.7%.

Effect of gender: The patients who returned with dry socket comprised 50 males and 88 females corresponding to 4.6% and 8.1% of the whole sample respectively. By comparing the incidence of dry socket in each group separately it was found that 15% of the female group and 10% of the male group returned with dry socket (**Table 1**). The difference was found to be statistically significant. ($\chi^2=6.18$, $df=1$ and $p<0.05$).

TABLE 1: DISTRIBUTION OF ALVEOLAR OSTEITIS (DS) ACCORDING TO GENDER

	Gender		Total
	Male	Female	
Alveolar osteitis -ve	451	498	949
+ve	50	88	138
Total	501	586	1087

Effect of impaction level: The wisdom teeth were classified into 3 groups according to the level of impaction as fully erupted, partially impacted, fully impacted. The highest incidence of alveolar osteitis (dry socket) was found in the second group (13.4%), but the differences between the 3 groups was not statistically significant ($\chi^2= 2.22$, $df= 2$ and $p>0.05$), **Table 2**.

TABLE 2: DISTRIBUTION OF ALVEOLAR OSTEITIS (DS) ACCORDING TO LEVEL OF IMPACTION

	Level of impaction			Total
	Fully erupted	Partially impacted	Fully impacted	
DS -ve	95	742	112	949
+ve	9	115	14	138
Total	104	857	126	1087

Effect of age: All the patients who underwent wisdom teeth extraction were between 17 and 36 year old, the highest incidence of dry socket was observed in patients between 20 and 26 year old, but this relationship between the age and the dry socket was not significant ($\chi^2= 23.65$, $df= 19$ and $p>0.05$), **Table 3**.

Effect of surgeons experience: The patients were distributed randomly between the surgeons who were classified into 2 categories: either Junior Surgeon or Senior Surgeon. As with other complications of wisdom teeth extraction, the incidence of dry socket was higher in patients operated by junior surgeons. The difference between the 2 groups was statistically significant. ($\chi^2= 36.75$, $df=1$ and $p<0.05$), **Table 4**.

TABLE 3: DISTRIBUTION OF ALVEOLAR OSTEITIS (DS) ACCORDING TO AGE

Age (year)	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	Total	
DS -ve	56	37	70	99	107	136	92	64	63	35	25	29	25	10	48	20	11	12	7	3	949	
+ve	6	7	9	12	10	17	18	13	10	11	5	1	5	5	4	2	2	1				138
Total	62	44	79	111	117	153	110	77	73	46	30	30	30	15	52	22	13	13	7	3	1087	

TABLE 4: DISTRIBUTION OF ALVEOLAR OSTEITIS (DS) ACCORDING TO SURGEON'S EXPERIENCE

	Surgeon		Total
	Junior Surgeon	Senior Surgeon	
DS -ve	419	530	949
+ve	99	39	138
Total	518	569	1087

Effect of surgery duration: The operation time was between 4 and 39 minutes for all patients, there was no evidence of a strong relationship between surgery duration and the incidence of dry socket. ($\chi^2=43.25$, $df = 33$ and $p>0.05$).

Effect of oral contraceptives: Two hundred forty five females were taking oral contraceptives during the period of surgery, 39 patients returned with dry socket, this number of patients correspond to 15.9 % of the female sample. The difference was not statistically significant. ($\chi^2= 2.96$, $df = 1$ and $p>0.05$), **Table 5**.

TABLE 5: DISTRIBUTION OF ALVEOLAR OSTEITIS (DS) ACCORDING TO THE USE OF ORAL CONTRACEPTIVES

	Oral contraceptive		Total
	No	Yes	
DS -ve	743	206	949
+ve	99	39	138
Total	842	245	1087

Effect of smoking: Fifty four patients out of 208 smokers returned with dry socket. The smokers sample corresponds to 19.1% of the whole sample. The difference of incidence of dry socket between smokers and non smokers samples was statistically significant ($\chi^2=40.84$, $df = 1$ and $p<0.05$), **Table 6**.

TABLE-6: DISTRIBUTION OF ALVEOLAR OSTEITIS (DS) ACCORDING TO SMOKING

	Smoking		Total
	No	Yes	
DS -ve	795	154	949
+ve	84	54	138
Total	879	208	1087

DISCUSSION

The development of alveolar osteitis (dry socket) after tooth extraction is a complication of exodontia that

has been a source of discomfort and pain for patients and of frustration for dentists²¹, and it is a well recognized complication of mandibular third molar extraction.

Alveolar osteitis (dry socket) is a disruption of the healing process at the extraction site after clot formation but before wound organization.³² It is characterized by moderate to severe pain at the extraction site that usually begins 2 to 3 days after surgery, often in the presence of a necrotic odor and a grayish discharge.³³ The pain is frequently refractory to the usual postoperative analgesics, with 45% of patients requiring 4 or more postoperative appointments before resolution of the symptoms.¹⁶

The exact pathophysiology and etiology of alveolar osteitis (dry socket) is not clearly known yet, there are many factors (local and systemic) that may play role in the development of this condition.^{4,8} Studies that attribute alveolar osteitis to increased fibrinolytic activity within the alveolus and clot are most widely accepted.⁸ It is unclear whether it is a local or systemic process and what factors lead to the initiation of the process.²⁰ Risk factors contributing to the occurrence of alveolar osteitis (dry socket) may include higher microbial counts,^{34,35} surgical difficulty,¹⁶ flap design and extent,³⁶ experience of the surgeon leading to unnecessary trauma,⁶ presurgical pathologic factors,¹² (such as unclean mouth) inadequate intraoperative lavage, a reactivated herpes simplex virus infection, increased age, female gender, oral contraceptive use, tobacco use, and a variety of other factors.²¹ However, the mechanism by which most of these factors increase the risk of alveolar osteitis is not clearly defined.

In our group of patients the most affecting observed factors that play a role in development of alveolar osteitis (dry socket) were, gender, the experience of the operating surgeons, and at last smoking. On the other hand the level of impaction of the wisdom teeth, the use of contraceptives, duration of surgery, and the age of patient all have a less prominent role in the development of alveolar osteitis (dry socket) as they found to be statistically not significant.

The relationship between gender and the development of alveolar osteitis is significant with high incidence in the female population but we could not find a strong evidence to explain this fact. Although it has been proposed that oestrogens, like pyrogens and certain drugs, will activate the fibrinolytic system indirectly, and thus are believed to contribute to the occurrence of alveolar osteitis by increasing lysis of the blood clot⁸. The relationship between oral contraceptives administration and the development of alveolar osteitis was not significant.

Smoking was also found to be a significant risk factor for the development of alveolar osteitis, no exact

explanation for this correlation could be advanced but it could be due to the introduction of a foreign substance that could act as a contaminant in the surgical site, and/or the suction applied to the cigarette which might dislodge the clot from the socket and interrupt healing. No references exist in the literature correlating the effects of heat from burning tobacco, contaminants in the smoke, or the systemic effects of the ingredients in cigarettes with alveolar osteitis.

As with other surgical complications, the incidence of alveolar osteitis became also higher in the patient sample treated by less experienced surgeons, more attention and experience is always required to reduce this complication.

Recognition of predisposing factors and application of relevant prevention methods are considered to be the key of success in the management of alveolar osteitis. Most of our results were consistent with the previously reported results in other studies, with some variations in the values and some exceptions.^{5,21,33}

CONCLUSIONS

This study showed that gender and smoking had a direct impact on post-extraction alveolar osteitis (dry socket) and the experience of the surgeon is considered of major importance in reducing it's frequency. Also it is concluded that recognition of predisposing factors and application of relevant prevention methods are considered to be the key of success in the management of dry socket (alveolar osteitis).

REFERENCES

- Awang MN. The aetiology of dry socket: a review. *Int Dent J* 1989;39:236-40.
- Noroozi AR, and Philbert RF. Modern concepts in understanding and management of the "dry socket" syndrome: comprehensive review of the literature. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2009;107:30-35.
- Sanchis JM, Saez U, Penarrocha M, Gay C. Tetracycline compound placement to prevent dry socket: a postoperative study of 200 impacted mandibular third molars. *J Oral Maxillofac Surg* 2004; 62:587-591.
- Blum IR. Contemporary views on dry socket (alveolar osteitis): a clinical appraisal of standardization, aetiopathogenesis and management: a critical review. *Int J Oral Maxillofac Surg*. 2002; 31:309-17.
- Oginni FO, Fatusi OA, Alagbe AO. A clinical evaluation of dry socket in a Nigerian teaching hospital. *J Oral Maxillofac Surg*. 2003; 61(8):871-6.
- Sisk AL, Hammer WB, Shelton DW, Joy ED. Complications following removal of impacted third molars: the role of the experience of the surgeon. *J Oral Maxillofac Surg*. 1986; 44(11):855-9.
- Bruce RA, Frederickson GC, Small GS. Age of patients and morbidity associated with mandibular third molar surgery. *J Am Dent Assoc*. 1980; 101(2):240-5.
- Birn H. Etiology and pathogenesis of fibrinolytic alveolitis (dry socket) *Int J Oral Surg* 1973; 2: 215.
- Awang MN. The etiology of dry socket: a review. *Int Dent J*, 1989;39:236-40.
- Larsen PE. Alveolar osteitis after surgical removal of mandibular third molars. *Oral Surg Oral Med Oral Pathol* 1992;73:393-7.
- Belinfante LS, Marlow CD, Myers W, Rosenberg C. Incidence of dry socket complication in third molar removal. *J Oral Surg*. 1973; 31(2):106-8.
- Al-Khateeb TL, El-Marsafi AI, Butler NP. The relationship between the indications for the surgical removal of impacted third molars and the incidence of alveolar osteitis. *J Oral Maxillofac Surg*. 1991; 49(2):141-5; discussion 145-6.
- Yoshii T, Hamamoto Y, Muraoka S, Furudoi S, Komori T. Differences in postoperative morbidity rates, including infection and dry socket, and differences in the healing process after mandibular third molar surgery in patients receiving 1-day or 3-day prophylaxis with lenampicillin. *J Infect Chemother*. 2002; 8(1):87-93.
- Erickson Ri, Waite De, Wilkison Rh. A study of dry sockets. *Oral Surg Oral Med Oral Pathol*. 1960; 13:1046-50.
- Lilly GE, Osbon DB, Rael EM, Samuels HS, Jones JC. Alveolar osteitis associated with mandibular third molar extractions. *J Am Dent Assoc*. 1974; 88(4):802-6.
- Osborn TP, Frederickson G, Small IA, Torgerson TS. A prospective study of complications related to mandibular third molar surgery. *J Oral Maxillofac Surg*. 1985; 43(10): 767-9.
- Chiapasco M, De Cicco L, Marrone G. Side effects and complications associated with third molar surgery. *Oral Surg Oral Med Oral Pathol*. 1993;76(4):412-20.
- Krekmanov L. Alveolitis after operative removal of third molars in the mandible. *Int J Oral Surg*. 1981; 10(3): 173-9.
- Ingibjörg S. Benediktsdóttir, Ann Wenzel, Jens K. Petersen, Hanne Hintze DD. *Oral Surgery, Oral Medicine, Oral Pathology* 2004; 97:438-46.
- Alexander RE. Dental extraction wound management: a case against medicating postextraction sockets. *J Oral Maxillofac Surg*. 2000; 58(5):538-51.
- Al-Belasy FA. The relationship of "shisha" (water pipe) smoking to postextraction dry socket. *J Oral Maxillofac Surg*. 2004; 62(1):10-4.
- Swanson AE. Reducing the incidence of dry socket: a clinical appraisal. *J Dent Assoc S Afr*. 1966; 21(5):155-62. 21.
- Miles R.Poor, John E. Hall, Anne S. Poor. Reduction in the incidence of alveolar osteitis in patients treated with Salicept patch, Containing Acemannan Hydrogel. *J Oral Maxillofac Surg* 2002; 60:373-79.
- Field EA, Nind D, Varga E, Martin MV. The effect of chlorhexidine irrigation on the incidence of dry socket: a pilot study. *Br J Oral Maxillofac Surg*. 1988; 26(5):395-401.
- De Boer MP, Raghoobar GM, Stegenga B, Schoen PJ, Boering G. Complications after mandibular third molar extraction. *Quintessence Int*. 1995; 26(11):779-84.
- Bloomer CR. Alveolar osteitis prevention by immediate placement of medicated packing. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2000; 90(3):282-4.
- Garcia AG, Grana PM, Sampedro FG. Does oral contraceptive use affect the incidence of complications after extraction of a mandibular third molar? *Br Dent J*. 2003; 26:194(8): 453-5.
- Ritzau M, Hillerup S, Branbjerg PE. Does metronidazole prevent alveolitis sicca dolorosa? *Int J Oral Maxillofac Surg*. 1992; 21:299.
- Sorensen DC, Preisch J. The effect of tetracycline on the incidence of postextraction alveolar osteitis. *J Oral Maxillofac Surg*. 1987; 45:1029.
- Trieger N, Schlagel GD. Preventing dry socket. A simple procedure. *J Am Dent Assoc*. 1991; 122:67.
- Fotos P, Koorbusch GF, Sarasin D, et al. Evaluation of intra-alveolar chlorhexidine dressing after removal of impacted mandibular third molars. *Oral Surg Oral Med Oral Pathol*. 1992; 73:383.
- Betts NJ, Makowski G, Shen Y, et al: Evaluation of topical viscous 2% lidocaine jelly as an adjunct during the management of alveolar osteitis. *J Oral Maxillofac Surg* 1995; 53:1140.
- Cohen ME, Simecek JW: Effects of gender-related factors on the incidence of localized alveolar osteitis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1995; 79:416.
- Brown LR, Merrill SS, Allen RE: Microbiologic study of intraoral wounds. *J Oral Surg* 1970; 28:89.
- Nitzan DW: On the genesis of "dry socket." *J Oral Maxillofac Surg* 1983; 41:706.
- Schow SR: Evaluation of postoperative localized osteitis in mandibular third molar surgery. *Oral Surg Oral Med Oral Pathol* 1974; 38:352.