

Dry socket following surgical removal of impacted third molar in an Iranian population: Incidence and risk factors

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Abstract

Introduction: Dry socket (DS) is the most common post-surgical complication following extraction of impacted molar teeth. Various risk factors have been mentioned for this complication including gender, age, amount of trauma during extraction, difficulty of surgery, inappropriate irrigation, infection, smoking, and oral contraceptive use. The aim of the current study was to evaluate the incidence of DS among surgical removal of impacted third mandibular molar in an Iranian Oral and Maxillofacial Clinic and also identifying the background risk factors.

Materials and Methods: A total of 189 patients with a total of 256 surgeries entered this study. Surgeries to remove impacted third mandibular molar teeth between April 2009 and August 2010 were included in this study. A questionnaire containing two sections was designed; in the first section demographic data along with smoking status, oral contraceptive use, menstrual cycle phase, systemic disorders, and use of antibiotics prior to surgery collected; in the second section data regarding difficulty of surgery according to radiograph and surgeon perception after surgery, length of surgery, and number of anesthetic carpules along with data regarding cases returning with DS recorded. Data were reported descriptively and analyzed with Fisher's exact test and Chi-square with the confidence interval of 95%.

Results: The incidence of DS was 19.14%. Age, gender, systemic disorder, and antibiotics use prior to surgery revealed no significant associations with DS ($P > 0.05$). However, incidence of DS was significantly relevant to smoking, oral contraceptive use, menstruation cycle, difficulty of the surgery according to pre-surgery radiograph evaluation and perception of surgeon post-surgery, length of surgery, and number of carpules used to reach anesthesia ($P < 0.05$).

Conclusion: It is recommended to identify high risk groups when performing extraction surgeries to consider measures in order to reduce postoperative complications.

Key words: Alveolar osteitis, dry socket, incidence, impacted third molar, risk factors

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Introduction

One of the most important and common complications following surgical removal of impacted teeth is dry socket (DS) (alveolar osteitis). This phenomenon is due to resolution of blood clot and exposure of alveolar bone. Pain, halitosis, activity reduction, and additional returns to visit

surgeon are of costs patient will pay.^[1] It is mostly prevalent in surgical extraction of mandibular third molar.^[2-8]

According to the insufficient experience of surgeons,^[9] amount of trauma during surgery,^[1,9] smoking habits,^[10,11]

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inappropriate irrigation during surgery,^[12] oral contraceptive use,^[13,14] and preoperative infection,^[15,16] the incidence of DS increase. Various studies had reported different incidence of DS in surgical removal of impacted mandibular third molar between 5% and 30%.^[17-19]

Although DS is a self-limited complication,^[20] systematic and locally application of antibacterial, anti-inflammatory, antifibrinolytic, and clot support agents had been proposed for treatment.^[21] However, prevention is more effective in DS. Identification of risk factors and eliminating them along with pharmacological prophylaxy had resulted in a significant decrease in incidence of DS.^[22]

The aim of this study was to determine the incidence of DS following extraction of impacted mandibular third molar and also to determine the potential risk factors attributed to its occurrence.

Materials and Methods

This cross-sectional study was performed in Dental Clinic of Oral and Maxillofacial Surgery during April 2009 to August 2010. A questionnaire containing two sections was designed. In section 1, demographic information of patients along with systemic disorders, smoking status, oral contraceptives use, approximate time in menstruation cycle (a one-row table with four columns was prepared to record the quarter of the menstruation cycle in which women were) according to their normal cycle period and corticosteroids or antibiotic consumption prior to surgery were recorded. In section 2 of the questionnaire, a chart was designed to include: (1) difficulty level of impacted tooth according to the sum score of values regarding spatial direction of tooth, depth of impaction, and relationship with ramus in panoramic radiograph before surgery [Table 1];^[23] (2) number of carpules used for anesthesia; (3) time of the surgery from the first incision till flap closure; (4) and a qualitative rank of extraction difficulty with three choices (easy, moderate, hard) at the end of surgery to evaluate surgeon perception. Section 2 was filled pre, during, and post surgery. As incidence of DS depends on surgeon experience, in this study patients who were referred to a single surgeon were investigated.^[9]

Prior to surgery, all the patients underwent a thorough scaling and oral prophylaxis, as it is a prerequisite for all operations in the study of Dental Clinic. All the surgeries followed similar procedure: Povidine iodine solution was applied around mouth; 2% lidocaine + 1:80,000 epinephrine cartridge was used to block inferior alveolar and long buccal nerves; after standard incision, mucoperiosteal envelop flap reflected. If needed, bone removal, tooth sectioning, bone recontouring were performed with low-speed handpiece under sufficient sterile solution irrigation; socket was irrigated with 60 ml

Table 1: Measurement of difficulty level of impacted teeth according to panoramic radiograph

Spatial direction (Value)	Depth (Value)	Ramus relationship (Value)	Difficulty index (Sum of values)
Mesioangular (1)	Level A (1)	Class I (1)	Minimally difficult (3-4)
Horizontal (2)	Level B (2)	Class II (2)	Moderate (5-7)
Vertical (3)	Level C (3)	Class III (3)	Very difficult (8-10)
Distoangular (4)			

saline; flap sutured using 3-0 silk suture; regimen of amoxicillin (500 mg, TID, $n = 20$) and Gelofen (400 mg cap, TID, for maximum 3 days) was prescribed.

Patients were informed to come back if they faced persistent or increasing pain from second to fifth postoperative day. At these occasions, patients were examined clinically for signs of DS. Cases of DS treated with this protocol: Irrigation with normal saline, intra alveolar dressing with Alvogyl iodoform (Septodont, Cambridge, Canada), systemic analgesic prescription, and systemic antibiotic in some cases.

Collected data were reported descriptively and analyzed using Chi-square and Fisher's exact tests. SPSS software version 11.5 was used with the confidence interval of 95%.

Results

A total of 256 impacted third molar teeth in 189 patients were included in this study. The patients' age varied between 18 and 48 with the mean of 23.49 ± 5.42 years. Among patients, 27 had systemic disorders consisting: Diabetes (22), hypertension (4), and asthma (1).

A total of 49 cases of DS were observed (incidence of 19.14%). Data regarding patients and tooth distribution according to various background factors are presented in Tables 2 and 3. The mean duration of surgeries was 8 minutes and 42 seconds.

There were no significant difference in incidence of DS according to gender, age, systemic disorders, and use of antibiotic 2 weeks prior surgery ($P > 0.05$) [Tables 2 and 3]. However, smokers and oral contraceptive users revealed significantly higher incidence of DS in comparison to non-smokers/former smokers and women who were not using oral contraceptives, respectively ($P < 0.05$) [Table 2]. In addition, women who were in the 2nd and 3rd quarters of their menstrual cycle revealed significantly higher incidence of DS both in oral contraceptive users and non-users ($P = 0.045$ and 0.026 , respectively) [Graph 1]. Difficulty of the surgeries (based on both radiograph and surgeon perception after surgery), number of injected epinephrine-containing anesthetics, and also

Table 2: Distribution of the patients according to the collected variables

Variable	No. of Patients (Percent)	DS Incidence	Significance
Gender			
Male	98 (51.85)	28 out of 138 (0.203)	0.636
Female	91 (48.15)	21 out of 118 (0.178)	
Age			
18-22	75 (39.68)	22 out of 120 (0.183)	0.743
23-26	86 (45.50)	18 out of 98 (0.184)	
>26	28 (14.81)	9 out of 38 (0.237)	
Systemic disorder			
Yes	27 (14.28)	6 out of 32 (0.187)	0.952
No	162 (85.72)	43 out of 224 (0.192)	
Antibiotic consumption (past 2 weeks)			
Yes	34 (17.99)	8 out of 48 (0.167)	0.690
No	155 (82.01)	41 out of 208 (0.197)	
Smoking			
Non-smoker	112 (59.26)	22 out of 148 (0.148)	0.020
Former smoker	23 (12.17)	6 out of 39 (0.154)	
Smoker	54 (28.57)	21 out of 69 (0.304)	
Oral contraceptive use			
Yes	51 (56.04)	16 out of 66 (0.242)	0.033
No	40 (43.96)	6 out of 52 (0.115)	

Table 3: Distribution of teeth according to the variables

Variable	No. of Teeth (Percent)	No. of DS (Incidence)	Significance
Difficulty score based on radiograph			
Minimal difficulty	98 (38.28)	16 (0.153)	0.012
Moderate	112 (43.75)	21 (0.161)	
Very difficult	46 (17.97)	12 (0.348)	
Number of carpules			
1	128 (50.0)	21 (0.164)	0.015
2	107 (41.80)	19 (0.177)	
3	21 (8.20)	9 (0.428)	
Difficulty according to surgeon perception			
Easy	138 (53.90)	20 (0.145)	0.001
Moderate	95 (37.11)	18 (0.189)	
Hard	23 (8.98)	11 (0.478)	
Surgery duration			
Less than mean ($\leq 8'.24''$)	170 (66.41)	26 (0.153)	0.043
More than mean ($> 8'.24''$)	86 (33.59)	23 (0.267)	

length of surgeries revealed a significant difference in incidence of DS ($P < 0.05$) [Table 3].

The mean time between surgery and returning with DS was 34.43 ± 15.23 hours. Most of the patients (42 out of 49) had two follow-up sessions before DS resolution. The mean treatment period was 8.2 ± 3.4 days.

Discussion

The results of the current study revealed that incidence rate of DS following surgical extraction of impacted mandibular

third molar were 19.14%. This finding is in accordance with the incidence rate between 5% and 30% reported in various previous studies.^[17-19]

DS starts 1 to 3 days after extraction with severe pain, halitosis, foul taste, and regional lymphadenitis.^[11,17] In clinical examination, there exists no blood clot in the socket and the bone is exposed.^[20] In 1973, Birn found higher fibrinolytic and plasmin activity along with higher amount of tissue activators in the socket.^[15]

Infection increases the release of tissue activators from the alveolar bone which leads to enhanced fibrinolytic activity and loss of blood clot.^[23] As a result, locally or systemically administration of antibiotics decreases the incidence of DS significantly.^[17,21,25-30] In the current study, we observed no significant differences in incidence of DS between subjects who had used antibiotics during 2 weeks prior the surgery and other patients. Resistance to the antibiotic, irregular use, or using antibiotics without physician prescription could be mentioned as a probable explanation for the results.^[17]

In addition, trauma could also increase the release of tissue activators and the incidence of DS.^[23] Although Swanson^[31] and Mayer^[32] found no relationship between trauma during surgery and incidence of DS, numerous reports support this claim.^[33] The surgeon experience effect on the amount of trauma in an extraction. Sisk *et al.*^[9] observed higher incidence of postoperative complication (including DS) in surgeries by residents when compared with oral and maxillofacial surgeons. Larsen also demonstrated lower incidence of DS when surgeries performed by experienced surgeon were compared with inexperienced surgeon.^[34] In contrast, Field *et al.*^[5] and Nusair and Younis^[35] found that experience has a insignificant effect on DS. In the current study, all the surgeries performed by one surgeon and this factor were eliminated.

In addition to the surgeon experience, difficulty of surgery also affect the amount of trauma and hence the incidence of DS. Heasman and Jacobs^[24] observed that harder extractions cause more traumas which could lead to higher incidence of DS. In this study, difficulty of the surgery by means of panoramic radiograph, surgeon perception after surgery, and length of the surgery were determinants of trauma during surgery. All of the mentioned factors revealed meaningful correlation with incidence of DS.

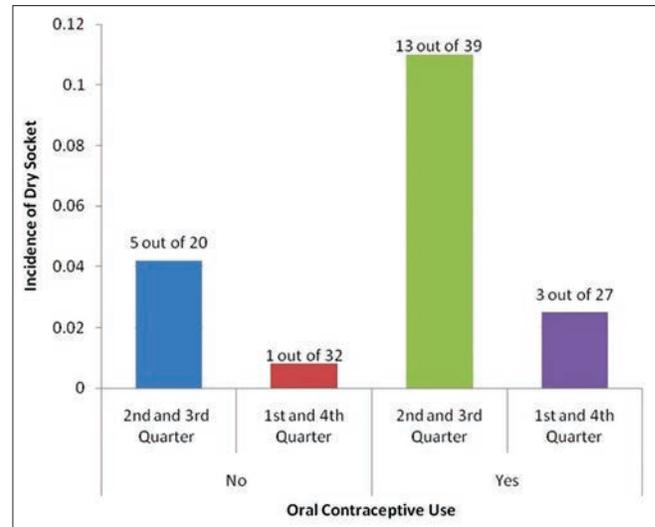
DS incidence is age dependent. Although, the peak age varies among different reports, most of the research works reveal 20 to 40 years of age as the peak period of DS incidence.^[11,36,37] However, age was not a determinant factor in incidence of DS in the current study. This could be related to the lower number of patients with ages over 26 years that have led to confounding results.

Conflicting reports exist according to the role of gender. Sweet and Butler found incidence of DS in women eight times more than men^[13] and Tjernberg found female to male proportion to be 5:1.^[39] However, Catellani,^[40] Al-khateeb *et al.*,^[17] and Nusair and Younes^[35] concluded that gender has no effect on DS which is in accordance with the result of our study. It should be mentioned that in western countries higher number of women smoke. But in eastern countries including current study country, number of smoker women is scare. On the other hand, more than half of the women were using oral contraceptives which could had neutralized the increasing effect of smoking in incidence of DS in men (as more than half of the men in this study were smoking regularly). As a result, no significant difference in incidence of DS was observed among males and females.

According to the results of this study, consumption of oral contraceptives in women increased the rate of DS significantly. The results are in accordance with the status that oral contraceptives could increase the DS risk double to triple.^[14,15,20] However, Larsen observed no significant difference in the rate of DS between subjects consuming oral contraceptives. This contrast may be due to small number of women using oral contraceptives in the mentioned study.^[24]

On the other hand, menstrual cycle increases the incidence of DS significantly. This increase is observed during 8th to 21st day of a 28-day cycle. During this period, the level of estrogen (estradiol) increases in blood circulation peri-ovulation and may contribute to the DS.^[41] Catellani *et al.* found that incidence of DS in oral contraceptive users increases during the 1-22 days of tablet when they consume; in contrast, it is significantly lower during the 23-28 days of tablet when they don't consume.^[14] Cohen and Simeck^[42] concluded that considering hormonal cycle in women for elective surgeries, the chance of DS could be reduced. This recommendation is valid according to the results of our study. There exists no study to address the effect of menstrual cycle on the incidence of DS in women not consuming oral contraceptives and this study is the first to pay attention to menstrual cycle as a potent risk factor in the development of DS. Further studies to evaluate this factor with a prospective method are recommended.

Smoking has been known as a risk factor in the occurrence of DS.^[11,12] In the current study, smokers showed higher incidence of DS in comparison to former smokers and non-smokers. There were also little differences between never smokers and former smokers. Larsen found smoking as one of the most significant factors related to DS.^[34] Meechan *et al.*^[12] observed a significant reduction in filling of an extracted socket with blood clot in smokers. They also reported increased incidence with heaviness of smoking habit. In contrast, Hermes *et al.*^[20] found no significant difference between smokers and non-smokers in developing DS. This contrast could be due to inappropriate



Graph 1: Istration of DS incidence according to the menstrual cycle and oral contraceptive use

methodology used to collect data regarding smoking status and also small number of smokers in their study. The effect of smoking could be attributed to the suction and heat produced during smoking or systemic mechanisms. As smokers may ignore post-surgery instructions, post-surgical smoking habit may also contribute to incidence of DS.^[43]

Local anesthesia has been mentioned as a risk factor in DS. However, some reports consider no role for local anesthesia in DS. Extractions under general anesthesia also result in DS when no local anesthesia is used.^[18] Meechan *et al.*^[12] observed that two infiltrations caused DS more than one injection. There exists possibility that epinephrine attenuates healing by reducing bleeding and oxygen tension and also increases fibrinolysis.^[33] We observed that the number of cartridges used to reach local anesthesia was a determinant factor in incidence of DS and higher incidence resulted when three cartridges were used.

Irrigation has also been reported to affect incidence of DS.^[13] Butler and Sweet^[44] demonstrated significantly lower incidence of DS when extraction socket was irrigated with 175 ml of saline rather than 25 ml. This benefit could be dedicated to the removal of contaminants (debris, bacteria, and enzymes).^[45] In the current study, the entire sockets were irrigated with 60 ml of saline as it has an identical effect on high volume lavage (170-350 ml).^[46]

As DS is a self-limited condition, the primary aim is pain management. In this study, the management was similar to that in the literature: Irrigation with saline, placing Alvogyl iodoform (Septodont, Cambridge, Canada), prescription of systemic analgesics, and in some cases along with antibiotics. The procedure repeated in each follow-up sessions. Most of the cases in this study participated in two follow-up sessions. The mean number of days before resolution was

8 days which is in accordance with duration of 7 to 14 days in the literature.^[18,33]

According to the results of the current study, it is recommended to perform elective surgeries of mandibular third molar extraction during menstruation in women (both oral contraceptive users and non-users). It is also revealed that type of impaction, smoking status, number of injected carpules, and length of the surgery could prognosticate the probability of DS development and appropriate measures to prevent it is more crucial in the mentioned conditions.

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