Factors associated with facial swelling severity following impacted lower third molar surgery: A prospective study

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ABSTRACT

Background: The ultimate purpose of this prospective study is to estimate and measure swelling associated with surgical extraction of impacted mandibular third molars in different four post-operative times and to identify the risk factors associated with determination of their risk degree.

Material and Methods: In this prospective cohort study 159 consecutive cases in which removal of impacted lower third molars in 107outpatients were evaluated. Five groups of variables have been studied which are regarded as a potential factor for swelling after mandibular third removal which will enable the surgeon to predict and counsel high risk patients in order to offer a preventive strategy.

Results: Facial measurements were carried out on 1st, 2nd days, 1st and 2nd week postoperatively to measure the swelling area in each time respectively The peak level of swelling was noted on the second post-operative day and subside by seven days but in some cases the swelling was still in minor degree while in most patients it was zero by day 14.

Conclusions: The degree of difficulty of the surgical extraction was the main indicators of risk factors for the swelling in all post-operative days because it involves all the other risk factors together.

Key words: Surgical extraction impacted mandibular third molar, swelling. (J Bagh Coll Dentistry 2013; 25(1):122-128).

INTRODUCTION

The mandibular third molars are the most frequently impacted teeth in man which makes their extraction one of the most frequent surgical procedures carried out in the world with the common approach of treatment is the surgical removal which may be considered as one of the routine aspects of oral and maxillofacial surgery performed on young adults and adolescents [1] .As such, numerous studies have been devoted to evaluate all their aspects, and major group of these studies deal with the post-operative complications by rate and type([1,2)] .As expected with any surgical operation, there are a number of intra- and post-operative complications which has significant post-surgical sequelae that may have both a biological and social impact[3]

Some authors [3-5] confirmed that the postoperative swelling as expected sequelae is usually associated with the surgical removal of lower third molars.

This swelling is direct and immediate postoperative tissue reactions as a consequences of the surgical procedure or can be a normal part of the healing process swelling are the most common postoperative complaints that influence the patients' quality of life in the days following surgery [6] therefore, numerous studies in literature [6-9] illustrated several factors that influence the occurrence of swelling including age; gender; medications; smoking; previous infection;poor oral hygiene;difficulty of extraction; length of extraction; surgical time ; technique and surgeon experience

In this prospective study, the postoperative swelling associated with surgical extraction of impacted mandibular third molars will be measured and evaluated in different times and the predictive risk factors with estimation of their risk degree will be determined which will enable the surgeon to predict and counsel high risk patients in order to offers a preventive strategy.

MATRIALS AND METHODS

Data Sampling and Criteria

The present prospective cohort study which is investigated 159 consecutive cases of removal of impacted lower third molars in 107 outpatients with the mean age of (25.54 ± 3.75) years and range of (16-31) years was performed by two members of the Dental Department of AlYarmouk University College between October 1, 2009 and December 31, 2010. The Ethics Committee of University had approved the study protocol. The

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inclusion criteria included healthy individuals with no systemic diseases; Patients are not given preoperative antimicrobial drugs or other medications that might influence healing, only one impacted tooth extracted each visit and for all procedures and local anesthesia alone is used. The exclusion criteria included the lingual splits technique and female patients who are pregnant or lactating

Study Variables

The variables of the study are sets of variables suspected to be related to complications. These sets of predictor variables are divided into five groups as shown in (Table 1):

1- Patient variables included sex, age and the side (Right/Left).Age is classified into three groups(19-22), (23-26) and (27-31) years
2- Indication for removal included pain, prophylactic, resorption of adjacent distal root of second molar, orthodontic purpose, associated pathological lesion and atypical facial pain.
3- Preoperative conditions variables included smoking, oral contraceptive and pericoronitis.
4- Radiographical variables in which the Pell and Gregory [10] and Winter [11] radiographical classifications are used to document the position of the impacted mandibular third molars. The numbers of roots are assessed then these classifications are used to predict the surgical difficulty and classified into: simple, moderate and difficult.
5- Operative-specific variables included type of flap (envelop or triangular), lingual flap retraction, bone removal, tooth sectioning, visibility of inferior alveolar nerve after extraction, intraoperative bleeding, the surgeon (both right-handed operators) and the operation time, which is with the mean of 27.41±12.44 minutes and range of 8-53 minutes and is classified into three groups (<21) ,(21-40)and(>40) minutes.

Surgical Technique

All surgical procedures were performed in the same clinic with similar equipment by one of two surgeons. Both surgeons had the same experience and worked with the same principles; the surgical field and all the surgical materials are sterile, the 5th year dental student were used as a surgical assistant in all the cases. One lower third molar extracted in each operation with the protocol that include local anesthesia, all teeth were removed from a buccal approach using either triangular or envelop flap. When it necessary to raise a lingual flap, a Howarth periosteal elevator is used to protect the lingual periosteum and the lingual tissues .Bone removal is done with burs in the conventional manner and, if necessary, the tooth is divided with burs before elevation. The flaps are sutured with a 4-0 silk suture. Postoperative instructions and prescribed drugs are explained to the patient. For the first 5 postoperative days all patients have given antibiotics (Amoxicillin 750 mg every 8 hours), drugs for patient with peptic ulcer (Ranitidine 300 mg three times daily) and an anti-inflammatory drug (Ibuprofen 600 mg every 8 hours for 4-5 days). And a mouth rinse (0.2% chlorhexidine digluconate) is performed every 12 hours for 15 days.

Postoperative Assessment

Patients were told to contact the clinic for any postoperative problem or if certain symptoms occur, such as pain that could not be relieved by the prescribed analgesics or post-operative bleeding. All patients were reviewed on the 1st and 2nd days and 1st and 2nd week postoperatively. The suture material was removed after one week.

Swelling Assessment and Measurements

A baseline measurement was carried out just before the surgery and similar measurements were carried out on 1st, 2nd days, 1st and 2nd week postoperatively. A single professional operator, repeating the procedure three times on each patient, made the measurements. The average of measurements was then taken (in cm) and recorded.

Two distances were considered to assess Facial measurements, that is the distance from the corner of the mouth to the ear lobe and the outer canthus of the eye to the angle of the mandible measured by a thread which was then transferred to a ruler, so facial area (cm^2) in each studied time for each case = (Vertical Measurement (cm) multiply by Horizontal Measurement) divided by two.

The difference between the postoperative and preoperative measurements was calculated to measure the swelling Area (cm^2) in four different times.

Statistical Analysis

The data obtained are statistically analyzed by SPSS (SPSS for windows, version 13, SPSS Inc., Chicago, IL, USA) the One-way analysis of variance (ANOVA) tests allow to determine if one given variable has a significant effect on postoperative swelling. The level of significance is set at (*P*) less than .01or .05.Partial eta-squared is used to measure strength of association and the effect of size of variables on postoperative

swelling. An LSD Pairwise Comparisons Test was applied for each of the independent variables which have a significant effect on postoperative swelling. The results were presented as the mean ± standard deviation and standard error of mean.

RESULTS

Post-Operative Swelling Evaluations

Facial measurements were carried out on 1st, 2nd days, 1st and 2nd week postoperatively to measure the swelling area in each time respectively as shown in (table 2 and figure1). Post-operative swelling reaches its peak level in the first 48 hours and the swelling continues in rare cases till the end of second post-operative week.

Risk Factors

There is no statistical significant difference between patient variables; indication for removal variables and preoperative conditions except the contraceptive which has a significant effect on the postoperativeswelling on the first and second postoperative days as shown in (table 3)

The most statistical significant radiographical variables and operative-specific variables on multivariate analysis on increasing the postoperative swelling are shown in (table 3). The other factors have not any statistical significant differences on the postoperative complications. Eta squared values indicate that effect sizes of difficulties in the 1stpostoperative week on postoperative swelling was medium while all other estimated effect size were relatively weak as shown in (table 3).

Comparisons Test was applied for each of the independent variables which have a significant effect on postoperative swelling as shown in (table 4) to see the most statistical significant variables between sub groups. So the most highly significant risk factors with high strengths of correlation in all the post-operative times as shown in (table 3) are:

1. Angulations: Distoangular impaction
2. Width: II and III
3. Depth: All levels
4. Difficulty: Moderate difficulty and very difficult
5. Operation Time: 21-40 and >40 minutes

DISCUSSION

Surgical removal of an impacted third molar often involves a lot of complications during the postoperative period, one of which is the swelling which contribute to major cause of postoperative discomfort experienced by most of the patients after third molar removal. These symptoms are not observed immediately after surgery but rather begin gradually [12] there are many factors that contributes to these situations which described as complex, but they originate from an inflammatory process initiated by surgical trauma [12,13].

Set off factors have been suggested as contributing to postoperative swelling. This paper deals with this welling as objective parameters for measurement. An investigation has been made to identify factors that influence the occurrence of severity of swelling.

During our observation the peak level of swelling was noted on the second post-operative day and subside by seven days but in some cases the swelling still in minor degree while in most of patients it was zero by day 14 which come in line with other studies [9, 14]

The authors [3,5,15] confirm that patient factors are regarded as one of the Factors affecting postoperative swelling, but in our studies we found that gender and age in addition to the tooth location variables don't have any significant effect.

Regarding to indications of removal it has been suggested that the presence symptoms at the time of removal must be considered to be a risk factor for postoperative complications [16] in the present study, however, we have failed to confirm this hypothesis.

In a study made by Grossi et al [6] there was no correlation between postoperative swelling and the smoker patients and he also confirms that there is a statistically significant correlation between postoperative swelling and the oral contraceptives, but our surprising result was completely opposite. This study fails to confirm the hypothesis that smoker use is a risk factor for severe postoperative swelling, and it confirms that oral contraceptives have a significant effect as risk factor in first and second day postoperatively.

Distoangular and vertical type of impaction when compared with horizontal and mesioangular type of impactions in this study have been shown to be associated with higher degree of swelling in all post portative days (p=0,000). The distoangular always has a significant effect as risk factor but the mesioangular type has no effect in other studies [17] while the other types are the point of controversies [6]. The type of impaction gives a prediction of the difficulty of extraction and hence the severity of postoperative reactions.

A statistically significant difference in swelling was noted regarding the level and depth of impaction in all post portative days with high level of significant (p=0,000) in the class II and III position and in level B and C in addition to the visibility of inferior alveolar nerve, these results

have statistically significant difference that go with all other studies [3, 6].

Significant influence over the magnitude of postoperative swelling was detected with respect to the degree of difficulty of the surgical extraction in all post-operative days specially in the first pot operative days (p=0,000, -P.E.S.0.341).This due to the amount of mucoperiosteum that has to be reflected and the amount of bone that supposed to be removed [6, 16].

In point of soft tissues view, we have notice that the degree of swelling has high significant associations only in the second post-operative days with triangular buccal flap and this agrees with other studies while lingual flap retraction has high significant associations only in the first post-operative week [16, 19].

There was a high significant correlation (p=0,000) between postoperative swelling and bone removal in all the postoperative periods because it produces a significant degree of trauma to the bony structures, potentially resulting in a significant inflammatory reaction [12,13]. On the other hand, the tooth sectioning is also a risk factor in the swelling but only in the second day and first week postoperatively and this came in agreement with others [3-5].

A lot of articles have been published on the relationship between the duration of the operation and postoperative swelling [5,13,16]. It has been confirmed by the present study that the longer the operation takes, the more magnitudes of swelling significance are in all the post-operative period(p=0,000).Authors believe that increasing surgical complexity is often a valuable predictor of inflammation- related sequelae [5,16,20].

The results have showed that the expertise of the surgeon does not seem to have a significant influence on the progress of swelling; some authors [20, 21] also notice that the degree of postoperative swelling seems to be influenced exclusively by the degree of difficulty and length of the surgical procedure regardless of the expertise of the surgeon.

In conclusion the peak level of swelling was registered on the second post-operative day .A patient's age, gender and indications of removal were not significantly correlated to the postoperative swelling .The tooth angulations, level and depth of impaction in addition to bone removal and tooth sectioning which will increase the duration of the operation showed a significant impact on the swelling in all the days postoperatively. The degree of difficulty of the surgical extraction was the main indicators of risk factors for the swelling in all post-operative days because it involves all the other risk factors together. Our statistical analysis identified no significant differences related to the expertise of the surgeon.

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Table 1: Study variables

Variable		No.	%	Variable		No.	%
Patient variables							
Gender	**Male**	73	68.2	**Teeth in male**		103	64.8
	Female	34	31.8	**Teeth in Female**		56	35.2
Age	**19-22 years**	46	28.9	**Teeth in Right**		84	52.8
	23-26 years	76	47.8	**Teeth in Left**		75	47.2
	27-31 years	37	23.3	Age Range (16-31) Age Mean(24.54±3.26)			
Indication for removal				**Preoperative conditions variables**			
Pain		53	33.3	**Smoking habit**	Yes	91	57.2
Prophylactic		44	27.7		No	68	42.8
Resorption of adjacent distal root of 2nd molar		22	13.8	**Contraceptives**	Yes	13	8.2
					No	146	91.8
Orthodontic purpose		17	10.7	**Pericoronitis**	Yes	38	23.9
Associated pathological lesion		14	8.8		No	121	76.1
Atypical facial pain		9	5.7				
Radiographical variables							
Angulations	**Mesioangular**	71	44.7	**Vertical**		29	18.2
	Horizontal	36	22.6	**Distoangular**		23	14.5
Width	**I**	57	35.8	**III**		28	17.6
	II	74	46.5				
Depth	**A**	57	35.8	**C**		19	11.9
	B	83	52.2				
Number of roots	**Multiple**	87	54.7	**Uncompleted**		15	9.4
	Single	57	35.8				
Difficulties	**Difficult**	24	15.1	**Simple**		37	23.3
	Moderate	98	61.6				
Operative-specific variables							
Flap type	**Triangular**	138	86.8	**Lingual flap retraction**	Yes	21	13.2
	Envelop	21	13.2		No	138	86.8
Bone removal	**With**	124	78	**Tooth Sectioning**	**With**	117	73.6
	Without	35	22		**Without**	42	26.4
I.A.N. visibility	**Yes**	14	8.8	**Intra-operative bleeding**	Yes	7	4.4
	No	145	91.2		No	152	95.6
Operation time	**<21 (minutes)**	41	25.8	Range (8-53minutes) Mean (27.41±12.44)			
	21-40 (minutes)	87	54.7				
	>40 (minutes)	31	19.5				
Surgeons	**Surgeon 1**	84	52.8	**Surgeon 2**	75		47.2

Abbreviations: IAN, inferior alveolar nerve; No., total number; %, percentage.

Table 2: Swelling Area (cm^2) in different post-operative times

	1st Post-operative Day	2ndPost-operative Day	1st Post-operative Week	2nd Post-operative Week
Mean	10.06	39.41	3.33	0.83
Standard Deviation	±12.94	±29.20	±7.09	±2.72
Stander Error	1.03	2.32	0.56	0.22
Minimum	00	00	00	00
Maximum	48.50	115.88	29.44	23.44

Table 3: The relation between most statistics significant variables with the postoperative swelling

Variable	1st P.O. Day		2nd P.O. Day		1stP.O.Week		2ndP.O.Week	
	Sig.	P.E.S	Sig.	P.E.S.	Sig.	P.E.S.	Sig.	P.E.S.
Contraceptives	0.004**	0.051 W	0.030*	0.030 W	0.077	-	0.252	-
Angulations	0.000**	0.118 W	0.000**	0.163 W	0.000**	0.311 W	0.000**	0.222 W
Width	0.000**	0.297 W	0.000**	0.271 W	0.000**	0.418 W	0.000**	0.198 W
Depth	0.000**	0.244 W	0.000**	0.208 W	0.000**	0.336 W	0.000**	0.148 W
Difficulty	0.000**	0.341 M	0.000**	0.401 W	0.000**	0.646 W	0.000**	0.316 W
Flap Type	0.232	-	0.009**	0.043 W	0.020*	0.034 W	0.134	-
Lingual Flap Retraction	0.252	-	0.117	-	0.000**	0.090 W	0.079	-
Bone Removal	0.021*	0.033 W	0.000**	0.080 W	0.001**	0.063 W	0.041*	0.026 W
Tooth Sectioning	0.158	-	0.044*	0.026 W	0.030*	0.030 W	0.065	-
Visibility of I.A.N	0.000**	0.158 W	0.000**	0.200 W	0.000**	0.448 W	0.000**	0.295 W
Intraoprative Bleeding	0.015*	0.037 W	0.000**	0.076 W	0.001**	0.074 W	0.003**	0.055 W
Operation Time	0.000**	0.218 W	0.000**	0.379 W	0.000**	0.485 W	0.000**	0.285 W

Abbreviations: P.O., postoperative; Sig., Significant; P.E.S., Partial Eta Squared; W., weak; M., medium; *: Significant at (p-value < 0.05), **: Significant at (p-value< 0.01)

Table 4: Comparisons Test was applied to each of the independent variables which have a significant effect on postoperative swelling

Variable		1st P.O. Day	2nd P.O. Day	1st P.O. Week	2nd P.O. Week
Angulations					
Mesioangular	**Horizontal**	0.677	0.539	0.620	0.880
	vertical	0.234	0.061	0.006**	0.062
	Distoangular	0.000**	0.000**	0.000**	0.000**
Horizontal	**vertical**	0.162	0.241	0.039*	0.123
	Distoangular	0.000**	0.000**	0.000**	0.000**
Vertical	**Distoangular**	0.009**	0.002**	0.000**	0.000**
Width					
I	**II**	0.072	0.029*	0.094	0.577
	III	0.000**	0.000**	0.000**	0.000**
II	**III**	0.000**	0.000**	0.000**	0.000**
Depth					
A	**B**	0.000**	0.000**	0.000**	0.005**
	C	0.000**	0.000**	0.000**	0.000**
B	**C**	0.001**	0.002**	0.000**	0.004**
Difficulty					
Very Difficult	**Moderate Difficulty**	0.000**	0.000**	0.000**	0.000**
	Minimum Difficulty	0.000**	0.000**	0.000**	0.000**
Moderate Difficulty	**Minimum Difficulty**	0.013*	0.000**	0.000**	0.097
Operation Time					
<21	**21-40**	0.248	0.000**	0.053	0.453
	>40	0.000**	0.000**	0.000**	0.000**
21-40	**>40**	0.000**	0.000**	0.000**	0.000**

Abbreviations: P.O., postoperative; *: Significant at (p-value < 0.05); **. , Significant at (p-value <0.01).

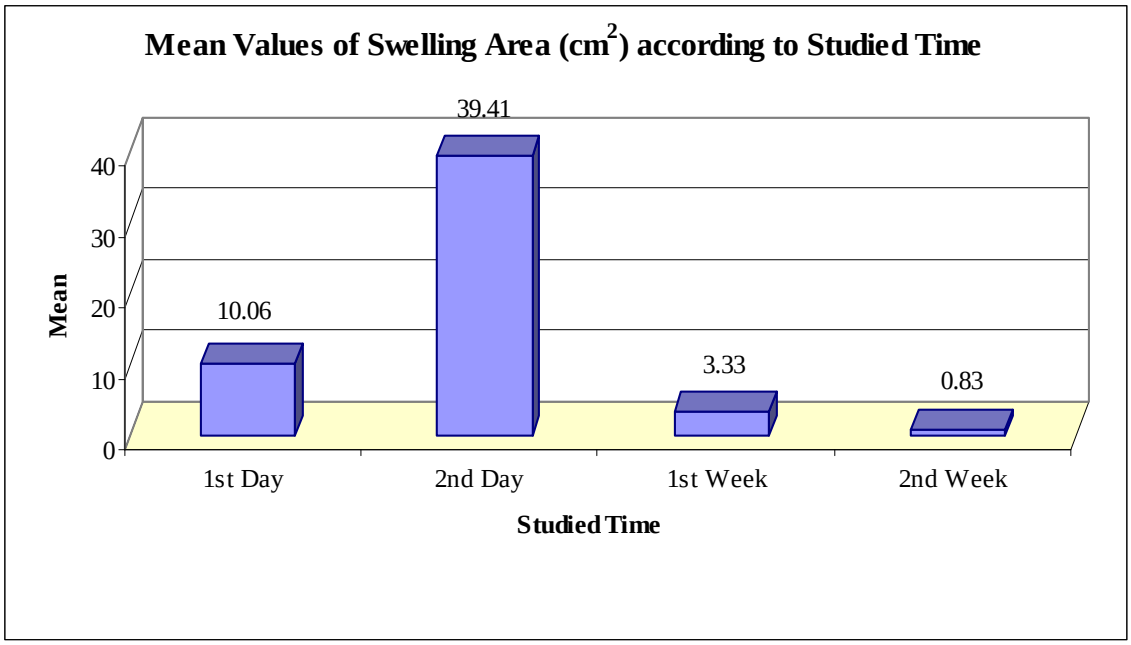

Figure 1: Mean values of swelling area (cm ^{2}) according to studied time