Effect of Age, Sex and Level of Surgical Difficulty on Inflammatory Complications After Third Molar Surgery

Otasowie D. Osunde · Birch D. Saheeb

Received: 4 April 2013 / Accepted: 16 September 2013 / Published online: 1 October 2013
© Association of Oral and Maxillofacial Surgeons of India 2013

Abstract

Background Patients' factors such as age and sex and surgical variables such as level of difficulty have been linked with surgical outcome in third molar surgery. The aim of this study was to determine the effect of these variables on inflammatory complications in patients undergoing third molar surgery.

Methods Patients referred to our institution for surgical extraction of their impacted lower third molar between January 2007 and December 2008 were the subjects of the study. Patients' demographics as well as types of impaction, indication and level of difficulty based on Pederson criteria were obtained. Post operative pain, swelling and mouth opening limitation were evaluated at day 1, day 2, day 3, day 5 and 1 week after the surgery and analyzed. A *p* value of less than 0.05 was considered significant.

Results A total of 150 patients aged 16–38 years (25.9 ± 4.47) met the inclusion criteria. Male accounted for 66 (44.0 %) while females were 84 (56.0 %), giving male to female ratio of 1:1.3. Age, sex and difficulty index had no effect on pain and trismus throughout the periods of postoperative evaluation (*p* > 0.05). Postoperative swelling was not affected by gender but patients above 25 years

who had high scores of difficulty index had more facial swelling.

Conclusion The results of this study shows that age, gender and the level of surgical difficulty have no effect on pain and mouth opening limitation after third molar surgery.

Keywords Age · Sex · Surgical difficulty · Inflammation · Third molar · Surgery

Introduction

Postoperative pain, swelling and trismus following third molar surgery are thought to arise from inflammatory response which is a direct and immediate consequence of the surgical procedure [1, 2]. The factors affecting postoperative complications could be patients' factors, tooth related factors and operative factors [3]. Patients' factors such as age and sex and the level of surgical difficulty have been linked with surgical outcomes in third molar surgery. Some studies have shown positive correlations between age and inflammatory complications after third molar surgery [4, 5] while others reported variable effects of gender on postoperative pain, swelling and trismus [6, 7]. The operative difficulty is another factor that has been thought to contribute to the development of inflammatory sequelae of pain, swelling and trismus.

Pederson's index [8] is a modification of Pell-Gregory's parameter for assessment of surgical difficulty in third molar surgery [9, 10]. A review of the literature shows that while a number of authors have reported on the effects of impaction types [9, 11] on postoperative pain, swelling and trismus, there is paucity of research into the effect of Pederson's difficulty index on these inflammatory parameters.

O. D. Osunde
Department of Dental and Maxillofacial Surgery, Aminu Kano
Teaching Hospital, Kano, Nigeria

Present Address:
O. D. Osunde (✉)
Department of Oral and Maxillofacial Surgery, University of
Calabar Teaching Hospital, Calabar, Nigeria
e-mail: otdany@yahoo.co.uk

B. D. Saheeb
Department of Oral and Maxillofacial Surgery, University of
Benin Teaching Hospital, Benin City, Nigeria

The present study evaluates the effect of age, sex and level of surgical difficulty based on the Pederson's criteria [8] on postoperative pain, swelling and trismus in patients undergoing third molar surgery at a Nigerian teaching hospital.

Patients and Methods

Patients referred to the Oral and Maxillofacial Clinic of our institution for surgical extraction of their impacted lower third molars between January 2007 and December 2008 were prospectively and consecutively recruited into the study. The study protocol was explained to the patients in detail, after which they provided written informed consent. Patients referred for surgical extraction of their impacted lower third molars that fulfilled the selection criteria were recruited to the study. The information obtained included age, gender, impaction side, indication for extraction and Pederson's difficulty index [8]. Patients on steroids, oral contraceptives, tobacco and alcohol consumption were excluded.

The surgical procedure was performed by the same surgeon and assistant under the same environment. Local anaesthesia was obtained using 2 % lidocaine with 1:80,000 adrenaline. A full thickness incision was made to prepare a 3-sided mucoperiosteal flap, with the mesial relieving incision as far forward as the distal third of the buccal surface of the second lower molar. The flap was reflected and osteotomy was performed using the buccal guttering technique. Bone was removed using a round bur on a straight surgical hand piece under constant irrigation with physiological saline. The tooth was removed with a Coupland elevator and sectioned when necessary. Toileting of the socket was carried out, haemostasis was achieved and the flaps were replaced and closure was achieved using silk 3/0 sutures. The duration of surgery starting from time of incisions to placement of last sutures was recorded in minutes.

The patients were evaluated by the same independent observer preoperatively and postoperatively on the first, second, third, fifth and seventh days after surgery. Pain was evaluated using a 10 cm visual analogue scale (VAS). Trismus was evaluated by measuring the distance between the mesial incisal corners of the upper and lower right central incisors at maximum mouth opening in cm, preoperatively, and on the first, second, third, fifth and seventh postoperative days, using vernier callipers. The measurements were done twice to determine the average score. The difference between the mean of each postoperative and the preoperative measurement indicated the trismus for that day. The facial swelling in cm was determined by measuring the distance from the corner of the mouth to the

attachment of the earlobe following the bulge of the cheek, and the distance from the outer canthus of the eye to the angle of the mandible [12]. The arithmetic mean of the 2 measurements was considered as the baseline. The difference between each postoperative measurement and the baseline indicated the facial swelling for that day. For the standardized measurements of trismus and facial swellings the independent observer was calibrated and the first and second measurements for these parameters at each of the evaluation period were subjected to reliability statistics and the intraclass correlation coefficient (ICC) was determined using a one way random effect model; the result was significant (single measure ICC = 0.998, 95 % confidence interval 0.998–0.999, p value = 0.000).

The data were analysed using Statistical Package for Social Sciences (SPSS) version 13. Qualitative variables were expressed as frequency and percentages while quantitative variables were expressed as mean and standard deviation. Independent sample t test and one way ANOVA were used as appropriate. A p value of 0.05 or less was considered significant.

Results

A total of 150 patients aged 16–38 years (25.9 ± 4.47) met the inclusion criteria. Males accounted for 66 (44.0 %) while females were 84 (56.0 %), giving male to female ratio of 1:1.3. The demographic and operative characteristics of surgical extraction in 150 patients are shown in Table 1. Mesioangular impaction ($n = 75$, 50.0 %) was the

Table 1 Demographic and operative characteristics of patients

Variable	Frequency	Percentage
Gender		
Male	66	44.0
Female	84	56.0
Types of impaction		
Mesioangular	75	50.0
Distoangular	48	32.0
Horizontal	21	14.0
Vertical	6	4.0
Side		
Left	90	60.0
Right	60	40.0
Surgical indications		
Recurrent pericoronitis	78	52.0
Apical periodontitis	42	28.0
Dental caries	15	10.0
Irreversible pulpitis	9	6.0
Neuralgic pain	6	4.0

most common type of impaction followed by distoangular impaction. Recurrent pericoronitis was the most common indication for surgery (52.0 %). The duration of surgery ranged from 17 to 41 min (29.85 ± 6.63) and this was positively correlated with the Pederson's index ($r = +0.647$, $p = 0.000$). Thus the more difficult extractions also took longer time to complete the operations.

There was no significant difference in the level of pain perception between patients age 16–25 years and those above 25 years of age throughout the periods of postoperative evaluation ($p > 0.05$). However, the mean pain score for the latter group was slightly higher except on day 7 where the mean pain score for the '16–25 years' age group was higher (Table 2). Sex and difficulty index did not affect pain perception to any significant extent. There were no statistical significant differences in the level of pain score between males and females ($p > 0.05$, Table 2). Similarly, pain score did not differ among the three levels of surgical difficulty according to the Pederson index (mild, moderate and severe), throughout the periods of postoperative evaluation ($p > 0.05$, Table 2).

The effect of age on postoperative swelling was not significant in the first four days post operation, except for day 7, which was significant at the 0.05 level ($t = -3.080$, $p = 0.030$, Table 3). However, patients above the 25 years age group had higher mean facial swelling compared to

patients in the 16–25 years age group in all the postoperative days (Table 3). Sex did not have any significant effect on postoperative swelling throughout the periods of evaluation ($p > 0.05$, Table 3), but females had a higher mean facial swelling compared to males. Similarly, difficulty index did not affect post operative facial swelling to any significant extent except on day 7 where there was a statistical significant difference among patients with mild, moderate and severe surgical difficulty based on Pederson's criteria ($F = 2.502$, $p = 0.045$, Table 3). Overall, there was a higher mean facial swelling in the following descending order (severe > moderate > mild).

There was no significant effect of age on postoperative limitation of mouth opening throughout the postoperative evaluation periods ($p > 0.05$). Overall, the mean trismus was higher in patients above 25 years of age compared to those of less than 25 years of age (Table 4). Sex did not have any significant effect on the extent of trismus in all the days postoperatively ($p > 0.05$, Table 4). Similarly, the degree of surgical difficulty did not affect trismus to any significant extent when comparison was made among patients with mild, moderate and severe level of difficulty ($p > 0.05$). However, the mean limitation of mouth opening was greatest in patients with severe difficulty, followed by moderate difficulty and was least in the mild difficulty (Table 4).

Table 2 Effect of age, sex and difficulty index on postoperative pain

Days	16–25 years = 72 (M ± SD)	>25 years = 78 (M ± SD)	df	t	p value	
Age						
1	4.64 ± 0.33	4.88 ± 0.51	148	−1.900	0.063	
2	2.90 ± 0.28	3.03 ± 0.33	148	−1.634	0.109	
3	1.14 ± 0.13	1.15 ± 0.15	148	−0.304	0.763	
5	0.58 ± 0.10	0.59 ± 0.11	148	−0.174	0.863	
7	0.23 ± 0.09	0.22 ± 0.07	148	0.768	0.446	
Days	Female = 69 (M ± SD)	Male = 81 (M ± SD)	df	t	p value	
Sex						
1	4.69 ± 0.44	4.83 ± 0.47	148	−1.058	0.295	
2	2.98 ± 0.26	2.96 ± 0.33	148	0.267	0.790	
3	1.16 ± 0.11	1.14 ± 0.16	148	0.393	0.896	
5	0.82 ± 0.09	0.79 ± 0.08	148	1.251	0.450	
7	0.21 ± 0.08	0.24 ± 0.08	148	−1.221	0.228	
Days	Mild = 75 (M ± SD)	Moderate = 27 (M ± SD)	Severe = 48 (M ± SD)	df	F	p value
Difficulty index						
1	4.58 ± 0.41	4.76 ± 0.45	4.77 ± 0.44	(2, 47, 49)	2.086	0.136
2	2.93 ± 0.27	2.97 ± 0.30	3.11 ± 0.27	(2, 47, 49)	1.337	0.273
3	1.13 ± 0.13	1.15 ± 0.14	1.23 ± 0.12	(2, 47, 49)	2.724	0.076
5	0.57 ± 0.08	0.59 ± 0.10	0.62 ± 0.07	(2, 47, 49)	1.011	0.371
7	0.22 ± 0.09	0.23 ± 0.08	0.24 ± 0.05	(2, 47, 49)	0.367	0.694

Table 3 Effect of age, sex and difficulty index on postoperative swelling

Days	16–25 years = 72 (M ± SD)	>25 years = 78 (M ± SD)	df	t	p value	
Age						
1	1.05 ± 0.11	1.10 ± 0.12	148	−1.253	0.216	
2	1.19 ± 0.09	1.24 ± 0.13	148	1.512	0.310	
3	0.71 ± 0.14	0.79 ± 0.14	148	−1.906	0.062	
5	0.47 ± 0.13	0.48 ± 0.11	148	−0.689	0.494	
7	0.11 ± 0.02	0.21 ± 0.03	148	−3.080	0.030*	
Days	Female = 69 (M ± SD)	Male = 81 (M ± SD)	df	t	p value	
Sex						
1	1.11 ± 0.13	1.05 ± 0.11	148	1.909	0.062	
2	1.25 ± 0.13	1.20 ± 0.10	148	1.557	0.126	
3	0.76 ± 0.11	0.75 ± 0.17	148	0.141	0.888	
5	0.48 ± 0.11	0.48 ± 0.12	148	0.001	0.999	
7	0.10 ± 0.03	0.10 ± 0.03	148	0.162	0.872	
Days	Mild = 75 (M ± SD)	Moderate = 27 (M ± SD)	Severe = 48 (M ± SD)	df	F	p value
Difficulty index						
1	1.01 ± 0.13	1.07 ± 0.10	1.19 ± 0.10	(5, 44, 49)	0.237	0.994
2	1.17 ± 0.10	1.21 ± 0.11	1.29 ± 0.04	(5, 44, 49)	1.091	0.397
3	0.72 ± 0.19	0.75 ± 0.15	0.79 ± 0.13	(5, 44, 49)	0.354	0.877
5	0.47 ± 0.14	0.50 ± 0.10	0.51 ± 0.05	(5, 44, 49)	1.235	0.301
7	0.08 ± 0.03	0.09 ± 0.03	0.11 ± 0.02	(5, 44, 49)	2.502	0.045*

Discussion

The present study compared the effect of demographic factors such as age and gender and the level of surgical difficulty on post operative pain, swelling and trismus after impacted lower third molar surgery. Age was categorized into those who were 25 years or below and those over 25 years. Similarly, the level of difficulty was grouped into mild, moderate and severe.

This study showed that age does not affect the level of pain perception between patients less than 25 years of age and those above. The result support the report of previous authors [3, 10, 13, 14] who found that age was not predictive of pain. However, the result contrasts those of other researchers [6, 11, 15] who found higher pain scores for older patients. Age, in this study was found to have variable effects on postoperative swelling, with the age group 25 years and above having statistically significant more swelling at day 7, compared to the 16–25 years age group. However, age had no significant effect on swelling at other days of evaluation. This partly supports the findings of previous authors [6, 10, 15] who observed greater swelling in older patients. The differences may be explained in terms of variation in the vascular permeability between older and younger patients [16].

Trismus was not affected by age, although the mean age group for the older patients was higher than those below

25 years of age. The result supports that of Chuang et al. [15] who found that age had no influence on trismus.

The difference between the present study and those cited above is the margin between younger and older patients, which differed among the different authors. Benediktsdottir et al. [6] and Yuasa and Sagiura [10] set the upper limit for younger patients at 26.5 and 40 years respectively. However, Chuang et al. [15] set his upper limit for younger patients, at 25 years, which is similar to the age-boundary in the present study. The age discrepancy may partly be responsible for differences in the results of this study and those of the other authors discussed above.

Opinion differs among different authors on the influence of sex on the postoperative morbidity following third molar surgery. Seward et al. [17] stated that female presents with more pain and facial swelling after third molar surgery. Benediktsdottir et al. [6] in their study, found that males have a lower risk for reporting more severe postoperative pain compared with females (Odd Ratio (OR) 0.31; $p = 0.001$ /OR 0.35; $p = 0.002$). The authors attributed the increased severity of postoperative pain in females to the higher occurrence of alveolar osteitis in females.

In the present study, sex was found not to affect the level of pain perception, as there was no statistical significant difference between males and females with regard to pain in all the postoperative days. The result supports that of

Table 4 Effect of age, sex and difficulty index on postoperative trismus

Days	16–25 years = 72 (M ± SD)	>25 years = 78 (M ± SD)	df	t	p value	
Age						
1	1.22 ± 0.11	1.20 ± 0.07	148	1.056	0.296	
2	1.03 ± 0.05	1.05 ± 0.08	148	−1.020	0.313	
3	0.79 ± 0.07	0.82 ± 0.09	148	−1.364	0.179	
5	0.55 ± 0.09	0.57 ± 0.12	148	0.489	0.627	
7	0.23 ± 0.08	0.24 ± 0.09	148	−0.099	0.922	
Days	Female = 69 (M ± SD)	Male = 81 (M ± SD)	df	t	p value	
Sex						
1	1.20 ± 0.07	1.21 ± 0.11	48	−0.257	0.798	
2	1.06 ± 0.07	1.03 ± 0.06	48	1.781	0.081	
3	0.82 ± 0.09	0.79 ± 0.08	48	1.251	0.217	
5	0.56 ± 0.12	0.56 ± 0.10	48	0.019	0.985	
7	0.24 ± 0.09	0.23 ± 0.08	48	0.447	0.657	
Days	Mild = 75 (M ± SD)	Moderate = 27 (M ± SD)	Severe = 48 (M ± SD)	df	F	p value
Difficulty index						
1	1.20 ± 0.11	1.21 ± 0.10	1.24 ± 0.09	(5, 44, 49)	0.235	0.936
2	1.01 ± 0.45	1.04 ± 0.50	1.06 ± 0.06	(5, 44, 49)	1.781	0.137
3	0.77 ± 0.08	0.83 ± 0.09	0.91 ± 0.12	(5, 44, 49)	1.510	0.206
5	0.51 ± 0.07	0.53 ± 0.05	0.57 ± 0.07	(5, 44, 49)	0.935	0.456
7	0.22 ± 0.05	0.26 ± 0.12	0.36 ± 0.21	(5, 44, 49)	1.386	0.249

Chiu and Cheung [18] who found no significant difference between mean pain scores in males and females. The result however differs from those of Benediktsdottir et al. [6] and Yuasa and Sagiura [10] who reported a higher postoperative pain score in males and that of Colorado-Bonnin et al. [19] who found that men yielded lower pain VAS scores than women ($F = 5.381$; $df = 1$; $p = 0.023$). Similarly, there was no significant effect of sex on postoperative swelling. The result contrasts that of Seward et al. [17] who reported more swelling in females. The results of the present study did not reveal any significant effect of sex on postoperative trismus.

Apart from the Pederson's index, other methods of assessment of difficulty of extraction of the impacted mandibular third molar have been described in the literature, most of which are based on radiographic findings. Winter [20] described the imaginary red line, which gives an assessment of the vertical depth and stated that the longer the red line the more difficult is the extraction. Pell and Gregory [21] classification has been used in assessing surgical difficulty (Pell-Gregory scale). Classes I, II and III have a score of 1, 2 and 3 respectively while positions A, B and C have a score of 1, 2 and 3 respectively. The duration of surgery in the hands of a single operator could be used as another method of assessment of surgical difficulty in third molar surgery [6]. Although the effect of operation time on

inflammatory complications was not evaluated in the present study, the duration of surgery was found to strongly correlate with the Pederson's index ($r = +0.647$, $p = 0.000$). This tends to strengthen the assertion that duration of operation can be used as an assessment tool for difficulty in third molar surgery.

The level of surgical difficulty did not have any significant effect on postoperative pain and trismus, but had a variable effect on facial swelling, which was found to be significant at day 7 post operation. The result of this study differs from those of Benediktsdottir et al. [6] and Yuasa and Sagiura [10] who reported significant association between high preoperative Pederson's index and high pain score on the VAS.

Conclusion

The results of this study have shown that age, gender and the level of surgical difficulty have no effect on pain and mouth opening limitation after third molar surgery. Older age and high levels of preoperative difficulty index were found to result in more postoperative facial swelling. Patients undergoing third molar surgery could be counselled on the possible expectations and potential surgical outcome based on the findings of this study.

References

- McGrath C, Comfort MB, Lo EC, Luo Y (2003) Changes in quality of life following third molar surgery—the immediate postoperative period. *Br Dent J* 194:265–268
- Osunde OD, Saheeb BD, Adebola RA (2011) Comparative study of effect of single and multiple suture techniques on inflammatory complications after third molar surgery. *J Oral Maxillofac Surg* 69:971–976
- Renton T, Smeeton N, McGork M (2001) Factors predictive of difficulty of mandibular third molar surgery. *Br Dent J* 190:607–661
- Chiapasco M, De Cicco L, Mamoneh K (1993) Side effects and complications associated with third molar surgery. *Oral Surg Oral Med Oral Pathol* 76:412–420
- Gbotolorun OM, Arotiba GT, Ladeinde AL (2007) Assessment of factors associated with surgical difficulty in impacted mandibular third molar extraction. *J Oral Maxillofac Surg* 65:1977–1983
- Benediktsdottir IE, Wenzel A, Petersen JK, Hintze H (2004) Mandibular third molar removal: risk indicators for extended operation time, post operative pain and complications. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 79:434–446
- Cappuzi P, Montebugnoli L, Vaccaro MA (1994) Extraction of impacted third molars: a longitudinal prospective study of factors that affect postoperative recovery. *Oral Surg Oral Med Oral Pathol* 77:341–343
- Diniz-Freitas M, Lago-Méndez L, Gude-Sampedro F, Somoza-Martin J, Gándara-Rey J, García-García A (2007). Pederson scale fails to predict how difficult it will be to extract lower third molars. *B J Oral Maxillofac Surg* 45:23–26
- Cerqueira PRF, Vasconcelos BC, Bessa-Nogueira RV (2004) Comparative study of the effect of a tube drain in impacted lower third molar surgery. *J Oral Maxillofac Surg* 62:57–61
- Yuasa H, Sugiura M (2004) Clinical postoperative findings after removal of impacted mandibular third molars: prediction of operative facial swelling and pain based on preoperative variables. *Br J Oral Maxillofac Surg* 42:209–214
- Bello SA, Adeyemo WL, Bamgbose BO, Obi EV, Adeyinka AA (2011) Effect of age, impaction types and operative time on inflammatory tissue reactions following lower third molar surgery. *Head Face Med* 7:1–8
- Amen MM, Lasken DM (1983) Prophylactic use of indomethacin for prevention of postsurgical complications after removal of impacted third molars. *Oral Surg* 55:448–551
- de Boer MP, Raghoobar BM, Stagenga B, Schoen PJ, Boering G (1995) Complications after mandibular third molar extraction. *Quintessence Int* 26:779–784
- Gulicher D, Gerlach KL (2001) Sensory impairment of the lingual and inferior alveolar nerves following removal of impacted mandibular third molars. *Int J Oral Maxillofac Surg* 30:306–312
- Chuang S, Perrott DH, Susarta SM, Dodson TB (2007) Age as a risk factor for third molar complications. *J Oral Maxillofac Surg* 65:1685–1692
- Barber BJ, Dutta S, Parameswaran S, Babbitt RA (1995) Age-related changes in perimicrovascular protein distribution. *Am J Physiol* 269:H1213–H1220
- Seward GR, Harris M, MGowan DA (1988) An outline of oral surgery part I, 2nd edn. Varghese Publishing House, Bombay. pp 52:70
- Chiu WK, Cheung LK (2005) Efficacy of preoperative oral rofecoxib in pain control for third molar surgery. *Oral Surg Oral Med Oral Pathol Oral Endod* 9:e47–e53
- Colorado-Bonnin M, Valmaseda-Castellon E, Berini-Aytes L, Gay-Escoda C (2006) Quality of life following lower third molar removal. *Int J Oral Maxillofac Surg* 35:343–347
- Winter GB (1926) Impacted mandibular third molars. Med Book Co, St. Louis
- Pell GJ, Gregory GT (1933) Impacted mandibular third molars: classifications and modified technique for removal. *Dent Digest* 39:330–338