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ORIGINAL RESEARCH

Comparison of operative 'difficulty' with post-operative sequelae in lower third molar surgery

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Abstract

Background: The outcome of studies on the effect of patients' factors, dental factors and operative factors on postoperative sequelae following surgical extraction of lower third molar have been unequivocal.
Objective: To determine the effect of surgical difficulty (using Pederson's scale), Body Mass Index (BMI) and operative time on the extent of post-operative pain, swelling and trismus following third molar surgery.
Methods: The study was a prospective analytical study of the effect of surgical difficulty, BMI, age and operative time – Total Intervention Time (TIT) - on the extent of post-operative pain, swelling and trismus. Eighty-four subjects with surgical extraction of impacted lower third molar were studied. All the subjects had a standard Peri-apical radiograph through which the difficulty index was calculated for all third molars using the Pederson scale. Anthropometric vertical and horizontal facial measurements and pain measurement were taken pre-operatively and post-operatively on days 1, 3, 5 and 7.
Results: Of the 84 subjects, 16 (19%) were males, while 68 (81%) were females in the ratio of 1:4.2. BMI showed a positive correlation with all the three variables and was significant for swelling on the post-operative days assessed while TIT showed a negative correlation with most of the variables and was significant for trismus.
Conclusion: This study showed that age and operative time might have an inverse relationship with the common post-operative complications after lower third molar surgery and BMI might influence the extent of these complications.

Keywords: Inflammatory complications, Lower third molar, Pederson scale, Tooth impaction.

Introduction

The surgical extraction of impacted third molars is a common oral surgical procedure. It is frequently associated with complications such as post-operative pain, swelling and trismus, [1] but less associated with complications such as severe infection, nerve damage, mandibular bone fracture, temporomandibular joint dysfunction and dry socket. [2] Surgical extraction invariably involves trauma to hard and soft tissues. The greater the tissue injury is, the more extensive the amount of tissue response and inflammation in the surgical area, [3] and this inflammation is regarded as a protective reaction of vascular connective tissue to damaging stimuli. It is associated with vasodilatation, increased vascular permeability, recruitment of inflammatory cells and the release of inflammatory mediators from these cells. [4] The prostaglandins and leukotrienes are critical among these inflammatory mediators. [3, 4] In contrast, this protective mechanism has been known to bring discomfort to patients and affect their quality of life, as a result of the resultant pain, swelling and trismus, otherwise called post-operative complications. [6, 7] The factors affecting these post-operative complications have been grouped into patients' factors, dental factors and operative factors. [7]

The patient factors include age, sex, body size or build, ethnic background, smoking, use of contraceptives and oral hygiene. [8] Gaya *et al.* [9] put the dental factors to include existing infection (pericoronitis), type of impaction, depth of impaction, relationship to the inferior alveolar nerve, the density of surrounding bone and associated pathology such as cyst or neoplasm. [9] Similarly, the operative factors include the use of drugs, type and extent of incision, wound closure technique, surgeons experience and duration of the operation. [10] These factors affecting postoperative morbidity have been used in determining the surgical or operative difficulty involved in the extraction of the mandibular third molar. [11,12]

Patients' factors such as age and sex and the level of surgical difficulty have been linked with surgical outcomes in third molar surgery. [11, 13, 14] However, some studies have not been able to identify such a relationship. [15-18] Age is the most studied patient factor. This might be due to poorer healing potential, denser bones and completed dental roots associated with advanced age. [18] The effects of sex on these post-operative complications, however, have been inconsistent. Yuasa and Sugiura; [19] Phillips *et al.*; [20] and Samir and Abdul, [21] showed that a significant positive correlation exists between sex and the development of postoperative complications. In contrast, Osunde and Saheeb, [7] Carvalho and do Egito Vasconcelos, [22], and Haraji and Rakhshan, [23] did not find any relationship between sex and post-operative complications. Rakhsan [24] opined that the controversy might be due to various missing latent variables (such as hormonal, psychological or genetic differences.) exhibited by the various studies. [24] Pain sensation is known to be subjective and is known to be influenced by different factors such as patient age, sex, level of anxiety and surgical difficulty. [5] In this regards, more prolonged operations are usually associated with more pain, and the pain further increases with the complexity of the procedure. [25] In theory, the swelling also may be particularly significant when the duration of surgery is prolonged, and the manipulation of tissues is extensive.

Various methods have been proposed to assess the surgical difficulty of the lower third molar. [11] Most of these methods are based on dental factors. Prominent among the proposed models are the Winter's, Pell and Gregory's, Pederson's, and the WHARFE (Winter's classification,

Height of the mandible, Angulation of the second molar, Root shape and morphology, Follicle development, Exit path) classification/ scoring systems. [12] Other methods based on other factors besides dental factors include those described by Renton *et al*. [8] and Gbotolorun *et al*. [11] However, the most widely used index is the Pederson's scale. It is a modification of Pell and Gregory Index for the assessment of surgical difficulty. Though, various authors, [8,11] have criticized it in that it has not been able to accurately predict the difficulty of lower third molar extraction, which some authors [10,13,19] have linked with the extent of development of inflammatory complications, classification and initial assessment are still usually made with this index because of its simplicity. This study aimed to determine the effect of surgical difficulty (using the Pederson's scale), Body Mass Index (BMI) and operative time on the extent of post-operative pain, swelling and trismus.

Methods

The study used a prospective, analytical design to study the effect of surgical difficulty (Pederson's scale), body mass index (BMI), age and operative time on the extent of post-operative pain, swelling and trismus. The study was carried out at the Dental Clinic of Babcock University Teaching Hospital, Ilishan-Remo, Ogun State, Nigeria. Ethical clearance for the study was obtained from the Health Research Ethics Committee of the Babcock University (BUHREC/366/16) and written informed consent was also collected from each subject before inclusion in the study.

All the subjects who presented for surgical extraction of impacted lower third molar at the Dental Clinic of Babcock University Teaching hospital, between 1st January 2017 and 30th June 2017, were the target population. The inclusion criteria included bony impaction of a lower third molar with two or more episodes of pericoronitis or soft tissue impaction of lower third molar which have passed the age of eruption of the third molar and at least 30mm of mouth opening. Exclusion criteria were a history of hypertension, diabetes mellitus, pregnancy or steroid use, oral contraceptives therapy or tobacco use or alcoholism.

Data collection

All the subjects had a standard Peri-apical radiograph showing the lower second and third molar and the retro-molar bone through which the difficulty index was calculated for all third molars using the Pederson scale. [12] The age, sex, weight, height and Body Mass Index (calculated as shown below) were also recorded.

The Pederson scale is an index widely used to determine this. It has three components:

a) Type of impaction (based on the angulation of the tooth, points 1, 2, 3 or 4 are allotted).
b) Class of impaction (based on the space between the ramus and the second lower molar. Points 1, 2 or 3 are allotted).
c) The position of impaction (based on the depth of tooth below the occlusal plane. Points 1, 2 or 3 are allotted).

The overall score is the sum of the scores for type, class and position of the impaction. The overall score was graded as follows:

Score 3 - 4 = Easy
Score 5 - 6 = Moderate
Score 7 - 10 = Difficult

The BMI was derived from height and weight as shown in the formula: BMI = kg/m^2 where kg was weight in kilograms and m^2 was the height in metres squared. A BMI of 25.0 kg/m^2 or more defined overweight while the healthy range was 18.5 kg/m^2 to 24.9 kg/m^2.

Pre-operatively, the patients with poor oral hygiene had scaling and polishing done while all the subjects had Chlorhexidine mouthwash for a mouth rinse. The following measurements were taken pre-operatively and post-operatively: vertical height, measured from lateral canthus of the eye to the angle of the mandible using a measuring tape in millimetres and horizontal height, measured from the skin of the commissure of the mouth to the middle of the tragus of ear on the same side with the aid of the same tape as above in millimetres (mm). The facial dimension was considered the sum of these two values. Inter-incisor distance (the medial edges of the upper and lower central incisors) was measured with Vernier calliper. The actual values of facial swelling and trismus were calculated by finding the difference between the post and pre-operative values. The pain was also measured with the use of a visual analogue scale (scale of 0 to 10). The post-operative measurements were evaluated after 24 hours, 72 hours, 5th day and on 7th-day post-operative periods. All anthropometric measurements were taken according to the description of Shaikh *et al.* [3]

All the patients had intramuscular 8mg Dexamethasone 30 minutes before surgery. Surgical extractions were carried out under local anaesthesia by a single operator (first author) who was not involved in the pre-operative evaluation of the patients. Surgical extraction of the impacted third molar was performed after achieving local anaesthesia by raising a standard buccal triangular flap and making a distobuccal gutter around the impacted tooth. The closure of the flaps was done using 3/0 black silk suture. The Total Intervention Time (TIT) was measured in minutes using a stopwatch, from the incision to the placement of the last suture.

Post-operatively, all the subjects had oral antibiotics: amoxicillin (GlaxoSmithKline) 500mg 8-hourly for five days, oral Secnidazole 400mg stat and oral Ketovail (Swipha) 200mg daily for three days. The post-operative instructions included the use of warm saline mouthwash eight times daily starting from the first post-operative day and strict warning to abstain from smoking for at least two weeks post-operatively.

The same methods were applied in measuring the anthropometric parameters post-operatively.

Data analysis

Statistical analysis was done using SPSS version 20. Means and standard deviations (SD) were calculated for age, facial swelling and mouth opening. The difficulty index for each impacted mandibular third molar, age, TIT and BMI were related to the actual facial swelling, degree of trismus and pain on the first, third, fifth and seventh postoperative days using Correlation analysis. P values less than 0.05 were considered statistically significant.

Results

A total of 84 subjects initially enrolled in the study completed the study. Seventy-nine (94.1%) were university undergraduates. The mean age of the subjects was 20.7 ± 4.1 years (range: 18–41 years). Seventy (83.3%) subjects belonged to the age group of 18-22 years (Table I). Sixteen (19%) were males while 68 (81%) were females giving a male-to-female ratio of 1: 4.25. Thirty-nine (46.4%) of the affected teeth were in the category of "moderate" difficulty (using the Pederson scale) (Table II). The duration of surgery ranged from 4 minutes to 60.1minutess. Comparison of the postoperative inflammatory sequelae within the post-operative days showed there were significant differences between the inflammatory sequelae on different postoperative days, as shown in Figures 1, 2 and 3.

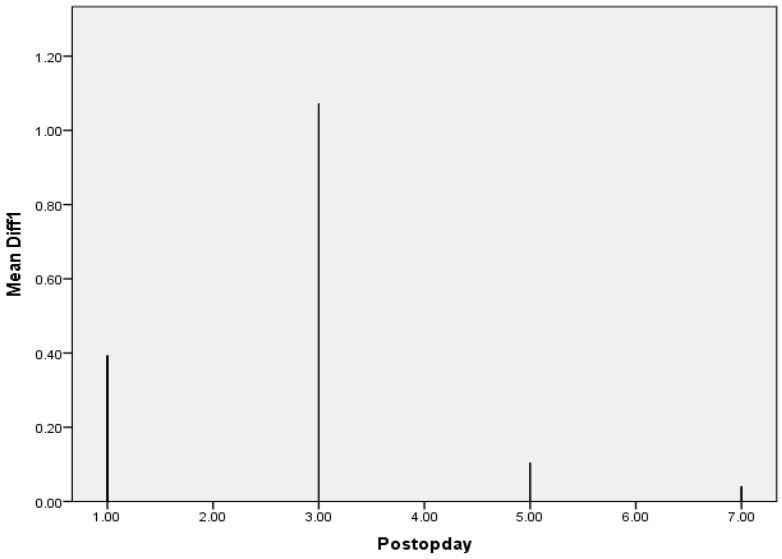
Table I: Distribution of study participants according to age groups

Age Group (Years)	Frequency	Percentage
18-22	70	83.3
23-27	7	8.3
28-32	4	4.8
33-37	2	2.4
38-42	1	1.2
Total	84	100.0

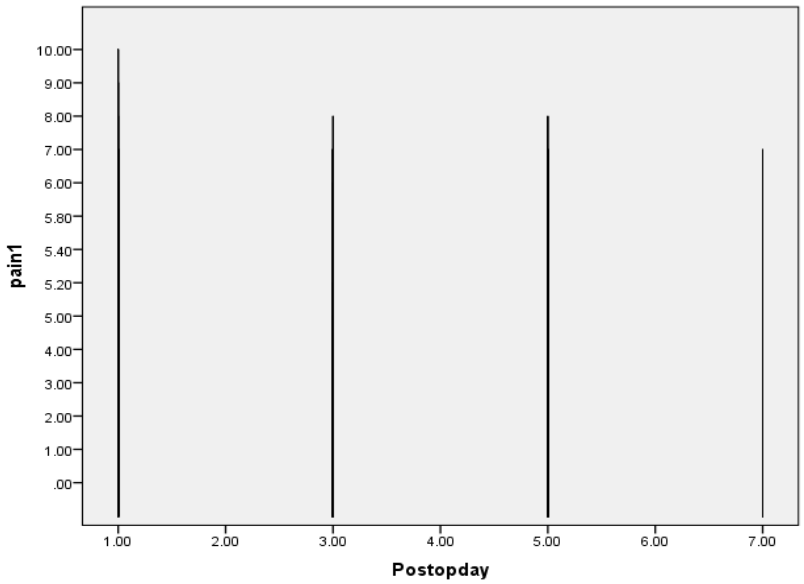
Table II: Difficulty Index Scores of the extracted Third Molar Teeth

Difficulty Index Score	Frequency	Percentage
3	20	23.8
4	10	11.9
5	16	19.0
6	23	27.4
7	12	14.3
8	3	3.6
Total	84	100.0

On the post-operative days 1, 3, 5 and 7, age showed a negative correlation with post-operative swelling, pain and trismus, without statistical significance. BMI showed a positive correlation with all the three postoperative complications and was particularly significant for swelling. Difficulty index was weakly correlated with all the three variables and was not statistically significant. TIT had a negative correlation with the three variables and was particularly significant for trismus on all the postoperative days (Tables III, IV, V and VI).

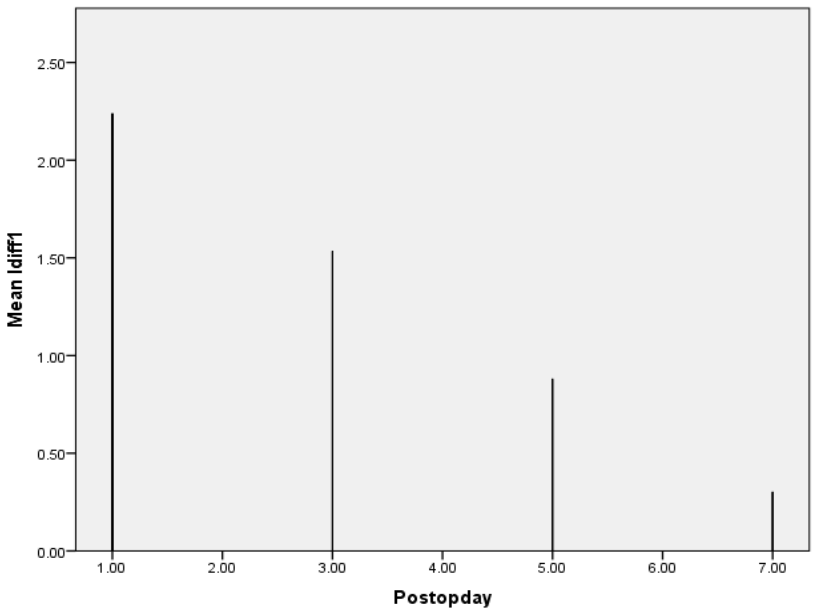


Mean diff1 = Mean Size of Swelling; Postopday = Post-operative day
Figure 1: Comparison of the intensity of swelling on the post-operative days



Pain1 = Pain Score; Postopday = Post-operative day

Figure 2: Comparison of pain scores on Post-operative days



Mean idiff1 = Mean Trismus; Postopday = Post-operative day

Figure 3: Comparison of Trismus on Post-operative days

Table III: Assessments on Post-operative Day 1

Variables	Statistical Test	Swelling (mm)	Pain score	Inter-incisal Distance Score (cm)
Age	Correlation	-0.021	-0.122	-0.044
	Significance	0.848	0.267	0.689
BMI (Kg/m²)	Correlation	0.257	0.123	0.032
	Significance	0.018*	0.265	0.772
Difficulty Index	Correlation	-0.043	0.051	0.027
	Significance	0.701	0.643	0.809
TIT (minutes)	Correlation	-0.112	-0.021	-0.223
	Significance	0.312	0.849	0.041

Table IV: Assessments on Post-operative Day 3

Variables	Statistical Test	Swelling (mm)	Pain score	Inter-incisal Distance Score (cm)
Age	Correlation	-0.016	-0.122	-0.049
	Significance	0.884	0.267	0.260
BMI (Kg/m²)	Correlation	0.214	0.120	0.061
	Significance	0.050*	0.279	0.581
Difficulty Index	Correlation	-0.091	-0.158	0.026
	Significance	0.411	0.151	0.812
TIT (minutes)	Correlation	-0.098	-0.021	-0.377
	Significance	0.377	0.850	0.045*

Table V: Assessments on Post-operative Day 5

Variables	Statistical Test	Swelling (mm)	Pain score	Inter-incisal Distance Score (cm)
Age	Correlation	0.009	-0.084	-0.065
	Significance	0.939	0.454	0.557
BMI (Kg/m²)	Correlation	0.245	0.118	0.081
	Significance	0.025*	0.289	0.463
Difficulty Index	Correlation	-0.068	-0.037	0.054
	Significance	0.541	0.738	0.026 [cross check]
TIT (minutes)	Correlation	0.051	-0.003	-0.384
	Significance	0.643	0.981	0.032*

Table VI: Assessments on Post-operative Day 7

Variables	Statistics	Swelling (mm)	Pain score	Inter-incisal Distance Score (cm)
Age	Correlation	0.020	-0.105	-0.141
	Significance	0.857	0.344	0.207
BMI (Kg/m^2)	Correlation	0.226	0.028	0.189
	Significance	0.039*	0.798	0.085
Difficulty Index	Correlation	-0.049	-0.096	0.083
	Significance	0.659	0.383	0.454
TIT (minutes)	Correlation	-0.081	0.014	-0.231
	Significance	0.464	0.897	0.655

Discussion

The complications of surgery might determine the patient's satisfaction. The clinician's knowledge of the incidence of these complications as well as the predisposing factors, could help to reduce morbidity and better decision making. [26] Most studies on the complications of third molar surgery mainly assessed significant complications such as lingual or inferior dental nerve paraesthesia, infection, dry socket and mandibular fracture. [26-28] However, short-term complications such as pain, swelling and mouth opening limitation, which are relatively common and could cause discomfort, have been less studied. [10.17]

The present study seemed to suggest that the higher the age, the less the extent of post-operative swelling, pain and trismus, even though the associations lacked statistical significance. This is contrary to most of the studies which considered the age and inflammatory complications. The outcome of comparative studies [9-11,13,14] was either in support of age as a predisposing factor or did not report any. [7,15,22,23] Studies with findings in support of age as a predisposing factor submitted that the bone in the older subjects is denser, leading to a more traumatic extraction. However, the findings in the present study suggest that the extent of inflammation mounted by the older subjects was poorer than that of, the younger ones, possibly because of reduced vascularity of their bones. This might be likened to the condition termed immunosenescence described by Danielle *et al*. where a gradual deterioration of the immune system occurs as a result of increased age. [29] Nevertheless, a majority (83%) of the subjects belonged to the 18 to 22 years age group; hence, more studies are desired to confirm this.

Studies that have considered BMI and complications of third molar surgery revealed more positive [11,30-32] association between the two parameters than a negative association.[33] Our study revealed a positive association between BMI and inflammatory complications after third molar surgery, and it was particularly significant for swelling on post-operative days 1, 3, 5 and 7. Reduced visibility because of chubby cheek and non-elasticity of the rima oris, among others, has been used as possible explanations. [32, 33] On the other hand, Ricardo and Belmiro, [30] reported that the periodontal spaces, especially around the second and third molar in obese and overweight patients are usually

atretic, possibly from overloading due to chewing activity. This narrowing causes tooth ankyloses and hinders the surgical removal of impacted third molars. [30] Tjeertes *et al.* [34] found out in their study that overweight/obesity predisposes to more intra- and post-operative surgical complications but also added that these complications are significantly worse with underweight. [34] Therefore, more studies are needed to determine the effect of specific BMI groups on postoperative complications in third molar surgery.

Various methods used to assess surgical difficulty in lower third molar surgery [11,12] are mainly based on dental factors. [11] The resulting levels of surgical difficulty determine the extent of post-operative complications or sequelae. The higher the difficulty level, the greater the degree of tissue injury and the more extensive the amount of tissue response and inflammation in the surgical area. [24] Although this study showed a positive association between post-operative trismus and the level of surgical difficulty, as well as an inverse relationship between surgical difficulty and swelling, both findings were not statistically significant. This is in contrast to the findings of Bello *et al.* [10] and Yuasa and Sugiura [19] but in agreement with the reports made by Renton *et al*. [8] and Osunde and Saheeb. [7] The cause of an inverse relationship between surgical difficulty and post-operative swelling might be because the majority (84%) of the third molar surgery in the present study had either mild or moderate level of difficulty.

The present study showed that operative time had a significant inverse relationship with trismus. This is contrary to the findings in most, if not all, the available studies. [10,35] Explanation provided by most of the previous studies regarding this observation is that more protracted surgical intervention increases tissue damage and vascular permeability. These occurrences cause more post-operative oedema and subsequently, more severe post-operative complications. [35] Muscle fatigue as a result of the opening of the mouth for a long time and the effect of dexamethasone, a potent anti-inflammatory agent, might be a plausible explanation in the present study. This is because the difference in mouth opening disappeared by the 7th postoperative day. Nevertheless, this is similar to the finding by Requena-Calla and Funes-Rumiche, [35], which also recorded lower pain figures for the experimental group that had longer operative time. [35]

Limitations to this study included the lack of cognizance for the effect of individual BMI groups on post-operative sequelae and the design of the study which was not randomized, controlled hence, it was difficult to prove the effect of patient factors on post-operative sequelae in third molar surgery.

Conclusion

This study has shown that age and operative time might have an inverse relationship with the common post-operative complications after lower third molar surgery and that BMI might influence the extent of these complications.

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Authors' Contributions: AAM conceived and designed the study. SMS and GMO participated in designing the study. AAM, AMO1, SMS AMO2 participated in data collection, analysis and interpretation. AAM, AMO1, SMS, AMO2 and GMO drafted the manuscript. All the authors approved the final version of the manuscript.

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