



Research Article

Influence of Pederson Score and its Constitutional Anatomical Parameters to Predict the Postoperative morbidity after Lower Third Molar Removal: A Prospective Cohort Study

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Abstract:

The purpose of present study is to determine the Influence of Pederson Score and its constitutional anatomical parameters in predicting the postoperative morbidity after the removal of impacted lower third molars. This clinical prospective cohort study included 50 patients with impacted mandibular third molars. Their position, depth and angulation was assessed using Intraoral Periapical and Orthopantomograms and subsequently all molars were assigned as easy, moderate or difficult to extract as per Pederson's difficulty index. Swelling, Trismus and Pain and Incidence of Alveolar Osteitis (AO) were evaluated preoperatively and postoperatively at 24, 48, 72 and 7 days. Difficulty Score predicted the Trismus (all follow-ups) and Pain at 72 hrs and at 7 days postoperatively. Mild group of Pederson scale did not depict the swelling as mild group revealed more swelling compared to moderate group. Ramus relation was not predictive of any complications significantly. Relative depth of third molars significantly predicted postoperative swelling (p -value=0.00). Angulation of the third molars significantly affected development of trismus (p -value=0.03). Incidence of AO was influenced by Ramus relation and Relative depth of third molar. Our experience showed that it is difficult to estimate actual morbidity by difficulty index/anatomic variables only and the demographic and clinical variables should not be ignored.

Keywords: Pederson Scale; Third Molar; Morbidity

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Introduction

The surgical removal of impacted mandibular third molars is one of the most commonly performed dento-alveolar procedure in dentistry [1] and complications associated with it are identified by their seriousness, reversibility, contributing factors, preventive measures, and management [2]. Postoperative complications after surgical removal of third molars may range from mild discomfort to major complications requiring hospitalization or result in permanent damage [3]. Pain, Trismus, Swelling and Alveolar Osteitis are the most common inevitable consequences among all that affect the patients' quality of life in the first few days after surgery [4]. Considering the high incidence of these complaints, identification of associated risk factors is must for individual treatment planning [5].

Risk factors may be related to the procedure, patient or surgeon². Patient related anatomic factors include the ramus relation (available mesiodistal space), depth of impaction and the angulations [3] and these are the most important variables in predicting difficulty of extraction and postoperative morbidity [6]. Pederson considered these three factors only and proposed a difficulty index for removal of impacted mandibular third molars [7]. The Pederson scale has been widely cited in various oral and maxillofacial surgical texts as a useful way to predict the difficulty of extraction but has never been universally accepted as true difficulty index as it does not take into account various other relevant factors such as bone density, root anatomy, curvature and cheek flexibility. Afterwards many complex preoperative scales such as the WHARFE scale have been proposed, but in view of their complexity they are rarely used in routine practice [8].

The aim of this prospective study is to evaluate the Influence of Pederson Score and its constitutional anatomical parameters in predicting the postoperative morbidity After Lower Third Molar Removal.

Materials and Methods

For the purposes of this clinical prospective cohort study, 50 patients with impacted mandibular third molars clinically indicated for surgical procedure were selected from the out-patient department. Study was restricted to patients with a fairly good general health according to American Society of Anaesthesiologist (ASA) 1 and 2 without any contraindication for minor oral and maxillofacial surgery and/or local or general anaesthesia. Lower third molars included were partially or completely covered by mucosa, had fully formed roots and were free of active infection.

Exclusion criteria included patients who required admission to the hospital (medically compromised or otherwise contraindicated for surgery under local anaesthesia) or those who were pregnant. Patients with missing first and second mandibular molar or patients with grossly decayed third molar were also excluded from the study.

Patients who satisfied the inclusion criteria were enrolled in the study after taking their consent. Detailed history, clinical examination and routine blood investigations (including Hb, TLC, DLC, BT, CT, and Random Blood Sugar) were conducted. Preoperative Orthopantomogram (OPG) and Intra-Oral Periapical (IOPA) X-rays were taken to assess the 3 categorial position variables: depth of impaction (Position A-C), the available space with respect to the ascending mandibular ramus (Class1-3), and the inclination of the

longitudinal axis of the molar (Winters). These position parameters were assessed using 4 tracing lines on the preoperative orthopantomographic radiographs of each patient: 1) the line of the occlusal plane of the lower first and second molar; 2) the cervical line of the first and second molar; 3) the anterior margin of the ascending ramus; and 4) the longitudinal axis of the third molar. The longitudinal axis forms an angle with the occlusal plane, providing objective classification of its angulation as follows: horizontal (0-30), mesioangular (31-60), vertical (61-90), and distoangular (>90). Subsequently all mandibular third molars were classified by a scoring system (score 3-10) using Pederson's difficulty index with scores of 3 to 4 grouped as "mild", those with scores of 5 to 7 grouped as "moderate" and those with scores of 8 to 10 as "difficult" to extract.

All the surgeries were performed by single operator with same technique, to keep the procedural and operator variables constant. The patients enrolled for the study were surgically draped using aseptic precautions. Povidone iodine (with available iodine 0.5% w/v) was used as a surgical scrub. Inferior alveolar nerve block, lingual and long buccal nerve blocks were given using 2% Lignocaine with adrenaline 1:2, 00,000. A standard incision was given and mucoperiosteal flap was raised. Bone was removed via guttering with copious saline irrigation using straight shank surgical carbide bur mounted in a straight surgical micro-motor hand piece to create a point of elevation. Tooth sectioning was carried out where required and tooth/roots elevated out of its socket. The socket was curetted to remove the remnants of dental follicle and sharp bony margins were smoothed using a bone file and irrigated using normal saline. The flap was sutured with 3-0 silk sutures with one suture placed immediately distal to second molar and the other sutures were placed to approximate the flap. Suturing of anterior releasing incision was not done. Post operative instructions were given and patients were prescribed antibiotics, analgesics and chlorhexidine mouth rinses. Patients were reviewed postoperatively after 24, 48, 72 hours and on the 7th day.

The following clinical parameters were noted pre-operatively & post-operatively

- (a) Pain was estimated subjectively by asking the patient to rate the nociceptive experience on a Visual Analogue Scale (VAS) of 0-10 preoperatively where '0' was marked as 'No Pain' and '10' as 'Most Severe Pain'.
- (b) Trismus was assessed as the amount of the reduction in mouth opening from preoperative value. Readings were taken using a millimeter scale. Examination was done preoperatively and postoperatively at 24, 48, 72 hours and on the 7th day. Data was recorded in millimetres.
- (c) Facial swelling was evaluated by measuring the difference in postoperative and preoperative facial measurement. For the facial measurement, authors calculated the mean of the distance between the ala of the nose to the tragus of the ear and the distance from the outer canthus of the eye to the angle of the mandible. Data was recorded in centimetres.
- (d) Incidence of Alveolar Osteitis.
- (e) The data were analysed using Statistical Package for Social Sciences (SPSS) and all 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

Based on Pederson’s Difficulty Score, 6 subjects were categorized in Mild group, 32 in Moderate group and 12 in Difficult group. Based on relative depth of the third molars, 22 subjects had molars in Position A and 28 had molars in Position B, with no subjects having impactions in Position C. Study included 3 subjects with Class 1 impacted molars and 47 subjects with Class 2 molars as per the ramus relationship. None of the molars was impacted in Class 3 situation. As per angulation, 18 molars were mesio angularly inclined, 16 were horizontal, 5 were vertical and 11 were disto angularly impacted.

A highly significant correlation was found between Position and swelling at 24 hours (p-value = 0.00). At 48 hours, 72 hours and 7 days no significant relation was found (p-values= 0.64, 0.11, 0.12) (Table1). No significant relation was inferred in terms of trismus (p values = 0.90, 0.48, 0.63, 0.82) and pain perception (p value = 0.79, 0.09, 0.49, 0.85) between Position A and B at various post operative follow up intervals (Table2, 3). No significant correlation was inferred in terms of swelling (p-values =0.16, 0.51, 0.71, 0.66), decreased mouth opening (p-values =0.74, 0.89, 0.92, 0.86) and pain perception (p-values 0.84, 0.48, 0.74, 0.13) between Class 1 and Class 2 molars (Table 1, 2, 3). No significant relation was found in terms of swelling (p-value = 0.10, 0.07, 0.94, 0.20) and between pain perception (p- values =0.32, 0.14, 0.52, 0.83) between various angulations at various follow up intervals (Table1, 3). A significant correlation was inferred between the various angulations and trismus at 24 hours (p value = 0.03). However, at 48 hours, 72 hours, and 7 days no significant correlation was seen (p-values =0.19, 0.36, 0.09) (Table 2). No significant relation was observed between Swelling (p value =0.66, 0.32, 0.84, 0.57), Trismus (p value = 0.06, 0.14, 0.29, 0.47) and Pain (p value = 0.32, 0.63, 0.61, 0.39) in various difficulty score categories (Table 1, 2, 3). Total 3 cases of Alveolar Osteitis were observed and all of them were observed in Position B and Class 2.

Table1 (Swelling vs Preoperative variables)

Pre-operative Variables			Mean				p-value			
			24 hours	48 hours	72 hours	7 days	24 hours	48 hours	72 hours	7 days
Anatomic Variables	Ramus Relation	Class 1	0.18	0.15	0.07	0.00				
		Class 2	0.11	0.11	0.05	0.00	0.16	0.51	0.71	0.66
		Class 3	-	-	-	-				
	Relative Depth	Position A	0.08	0.11	0.03	0.00				
		Position B	0.14	0.12	0.07	0.01	0.00**	0.64	0.11	0.12
		Position C	-	-	-	-				
	Angulation	Mesioangular	0.14	0.14	0.05	0.00				
		Vertical	0.15	0.18	0.07	0.01	0.10	0.07	0.94	0.20
		Distoangular	0.11	0.09	0.05	0.00				
		Horizontal	0.08	0.09	0.05	0.00				
	Difficulty Index	Easy	0.12	0.16	0.05	0.00				
		Moderate	0.10	0.11	0.04	0.00	0.66	0.32	0.84	0.57
		Difficult	0.13	0.10	0.06	0.00				

Table2 (Trismus vs Preoperative variables)

Pre-operative Variables			Mean				p-value			
			24 hours	48 hours	72 hours	7 days	24 hours	48 hours	72 hours	7 days
Anatomic Variables	Ramus Relation	Class 1	14.00	13.33	11.33	7.67				
		Class 2	15.74	14.06	11.85	6.94	0.74	0.89	0.92	0.86
		Class 3	-	-	-	-				
	Relative Depth	Position A	15.45	13.05	11.14	6.73				
		Position B	15.79	14.79	12.36	7.18	0.90	0.48	0.63	0.82
		Position C	-	-	-	-				
	Angulation	Mesioangular	12.78	12.00	10.17	4.94				
		Vertical	10.0	9.6	7.4	2.6	0.03*	0.19	0.36	0.09
		Distoangular	21.00	17.64	14.55	8.55				
	Difficulty Index	Horizontal	16.94	15.19	13.19	9.56				
		Easy	11.0	9.00	6.83	3.83				
		Moderate	14.71	13.75	12.0	7.53	0.06	0.14	0.29	0.49
		Difficult	20.4	17.25	13.83	7.08				

Table3 (Pain vs Preoperative variables)

Pre-operative Variables			Mean				p-value			
			24 hours	48 hours	72 hours	7 days	24 hours	48 hours	72 hours	7 days
Anatomic Variables	Ramus Relation	Class 1	4.00	2.67	2.33	2.00				
		Class 2	4.23	3.47	2.77	0.79	0.84	0.48	0.74	0.13
		Class 3	-	-	-	-				
	Relative Depth	Position A	4.14	2.91	2.50	0.82				
		Position B	4.29	3.82	2.93	0.89	0.79	0.09	0.49	0.85
		Position C	-	-	-	-				
	Angulation	Mesioangular	4.44	4.17	3.11	0.83				
		Vertical	3.40	2.80	1.60	0.60	0.32	0.14	0.52	0.83
		Distoangular	4.91	3.45	3.00	1.18				
	Difficulty Index	Horizontal	3.75	2.75	2.50	0.75				
		Easy	3.66	2.83	2.00	0.16				
		Moderate	2.12	2.10	2.44	1.58	0.32	0.63	0.61	0.39
		Difficult	4.91	3.75	3.08	0.83				

*Significant; **Highly Significant

Discussion

It is generally accepted that it is difficult to estimate actual difficulty by only radiologic methods and only intraoperatively can actual difficulty be estimated [9, 10]. There have been various efforts at determining a reliable model for assessment of surgical difficulty. The first attempt was by McGregor in 1976, he attempted to create a multivariate model based on panoramic radiographic findings. Afterwards, The Pederson scale (based on radiographic assessment solely) was widely cited in various oral and maxillofacial surgical texts as a useful way to predict the difficulty of impacted lower third molar surgery. Afterwards many complex preoperative scales such as the WHARFE scale have been proposed, but in view of their complexity they are rarely used in routine practice [8].

It is a general consideration that extraction difficulty is directly related to the inevitable postoperative consequences and secondarily in the setting of elective operations, such as third molar removal, patients expect more than just a litany of benefits and risks of the operation. They demand more information about the expected outcomes after the operation and want to know, how the postoperative course of an operation will affect their activities of daily living or duration of disability. Keeping these points in mind, present study was conducted to assess the reliability of Pederson scale in relation to postoperative morbidity and whether the preoperative assessment of surgical difficulty was a valuable marker for predicting inevitable postoperative consequences. Till date, various researchers have tried to evaluate the relevance of Pederson scale in relation to surgical difficulty and have even compared the credibility of various scales in depicting the extraction difficulty. But hereby authors have limited their work only to determine the Influence of Pederson Score and its constitutional anatomical parameters on the postoperative morbidity.

The Study revealed that the Trismus (at all follow up intervals) and Pain at 72 hrs and on the 7th day were positively predicted by difficulty level but were not statistically significant. However, in relation to swelling “Easy” group revealed comparatively more swelling than the “Moderate” group. Difficult group showed the maximum amount of swelling at all postoperative follow up intervals as compared to the other groups.

RELATIVE DEPTH of the third molar has a positively significant effect on the development of swelling [11, 12, 13] as deeper impactions require lengthy procedures involving more bone removal and more tissue damage which is directly proportional to vascular permeability and thus leads to more swelling [12]. Authors observed a highly significant correlation to swelling at 24 hours ($p\text{-value} = 0.000$). Molars impacted at Position B had greater facial swelling as compared to those in Position A at various follow up intervals. Although position of the molars had no significant correlation ($p\text{-value} > 0.05$) with pain and trismus, it was seen that the incidence of pain and trismus was greater in Position B impactions as compared to Position A. **Yuasa et al.** [14] revealed that severe pain and swelling were significantly correlated with depth ($p\text{-value} = 0.03, 0.03$). **Chuang et al.** [12] concluded that depth of impacted molar was associated with increased risk of inflammatory complications ($p\text{-value} < 0.001$). **Kim** [11] found that removal of deeply impacted teeth led to more swelling and pain on the 1st and 7th day postoperatively ($p\text{-values} = 0.013, 0.016$ respectively). This was in agreement with the authors finding. In contrast **Baqain et al.** [3] concluded that depth of impacted molar has a significant positive correlation ($p\text{-value} = 0.001$) with trismus. Depth of third molar also depicted incidence of Alveolar Osteitis as all 3 cases of AO were observed in Position B subjects and none in Position A.

Difficult **RAMUS RELATION** predisposes to greater tissue manipulation and larger wounds which may lead to greater incidence of post operative inflammatory complications [12]. In contrast authors observed that Class 1 cases were associated with more facial swelling and had no significant correlation ($p\text{-value} > 0.05$). These findings echo the results of **Yuasa et al.** [14] who found greater swelling in Class 1 cases. However,

their results showed a significant correlation (p -value = 0.04). Incidence of Alveolar Osteitis was also influenced by ramus relation as all 3 cases of AO were observed in Class 2 and none in Class 1.

ANGULATION of the third molars significantly affects the development of post operative inflammatory complications [3, 13, 15, and 16]. Horizontal and distoangular impactions have difficult crown-root access and require more flap reflection as compared to vertical and mesioangular impactions, thus have a greater chance of severing adjacent muscles. This leads to the development of more trismus [2] secondary to masticatory muscle and fascial inflammation which is often the result of surgical trauma. Angulation was significantly correlated to trismus at 24 hours (p -value = 0.03). Greater incidence of decreased mouth opening was seen in distoangular and horizontal impactions followed by mesioangular and vertical impactions. The correlation is not significant in terms of swelling and pain. Similarly **Baqain et al.** [3] also revealed a significant positive correlation (p -value = 0.05) of angulation with the decrease in mouth opening. **Bui et al.** [13] in their analysis revealed that angulation (p -value = 0.008) was statistically associated with complications. They found horizontal impactions to be more likely to result in inflammatory complications. **Malkawi et al.** [15] revealed inclination of the impacted lower third molar was one of the best predictors of the occurrence of immediate and late complications like pain (p -value = 0.000). **Ingibjorg and Wenzel** [16] revealed horizontally positioned teeth to be associated with greater incidence of inflammatory complications as opposed to vertically positioned teeth (p -value = 0.014).

It is important to take into consideration the strengths and weaknesses of the study before drawing conclusions. The strength of our study is that it is a prospective cohort study. The prospective design minimizes selection and recalls bias of the subjects, allows the calculation of incidence of disease and can enable the examination of multiple outcomes of even single risk factor. The follow-up was conducted at 24 hrs, 48 hrs, 72 hrs and 7 days postoperatively. So a comprehensive assessment of the effect of various predictor variables and a regular pattern of change of postoperative variables could be obtained. Another notable forte of this study was that the outcome variables chosen to assess pain, trismus and swelling were all numerical. So the exact relations of preoperative variables with inflammatory complications could be extracted. The weakness of our study was limited number of patients included in the study. Authors believe that more conclusive results would have been obtained to assess the Influence of Pederson's difficulty score and its constitutional anatomic variables on post operative morbidity with large sample size. Another limitation could be selection bias, since all mandibular third molars removed in the study were extracted by maxillofacial surgeons, there is a possibility that the subjects included are not representative of the entire population because easier cases might not get referred to the maxillofacial surgeons and may be treated by general dentists.

Based on the study carried out and statistical analysis of the data collected, the following conclusions can be drawn:

- ❖ It is difficult to estimate actual morbidity by difficulty index/anatomic variables only.
- ❖ Difficulty Score predicted the Trismus (at all intervals) and Pain at 72 hrs and at 7 days postoperatively.
- ❖ Mild group revealed more swelling compared to moderate group but maximum postoperative swelling was observed in difficult group only.
- ❖ Ramus relation was not predictive of any complications.
- ❖ Relative depth of third molars was related to post operative swelling but was not significant in relation with other post operative complications.
- ❖ Angulation of the third molars significantly affected development of trismus.
- ❖ Incidence of Alveolar Osteitis was influenced by Ramus relation as well as Relative depth of third molar.

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