

# Relationships between Surgical Difficulty and Postoperative Complications in Mandibular Third Molar Surgery.

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Received: February 2018

Accepted: February 2018

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## ABSTRACT

**Background:** The objective of the study was to investigate the effect of surgical difficulty detected using the Pederson and Parant scales and the duration of the surgery on postoperative pain, swelling, and trismus. **Methods:** Surgical difficulty for each mandibular third molar was estimated using the Pederson and Parant scales and the duration of the surgery in 50 healthy patients. Postoperative pain, swelling, and trismus were evaluated preoperatively and on the 2nd and 7th days post-operation and the recorded data was analyzed with statistical significance set at  $P = 0.05$ . **Results:** Age was found to be a risk factor for 7th day postoperative pain ( $p = 0.032$ ) and trismus ( $p = 0.008$ ). The relationship between the duration of surgery and the Parant scale was statistically significant ( $p = 0.000$ ), and the duration of surgery was found to be a risk factor for 7th day postoperative trismus ( $p = 0.017$ ). **Conclusion:** There were no significant relationships between the postoperative complications and the Pederson and Parant scale scores.

**Keywords:** Impacted third molar, Parant scale, Pederson scale, Postoperative complications, Surgical difficulty.

## INTRODUCTION

The surgical removal of impacted mandibular third molars is one of the most commonly performed dentoalveolar procedure in oral and maxillofacial surgery and is associated with various postoperative complications,<sup>[1-6]</sup> and postoperative pain, swelling, and trismus following third molar surgery are thought to arise from the inflammatory response as a direct and immediate consequence of the surgical procedure.<sup>[7]</sup> Moreover, they are affected by many factors and variables related to the patient, the tooth, and the operation.<sup>[6-9]</sup> Mandibular third molar surgery invariably causes different amounts of minor complications and negatively affects the patient's postoperative quality of life,<sup>[9]</sup> thus it is essential to evaluate surgical difficulty and to inform the patient of the potential challenges.

Preoperative evaluation of the third molar both clinically and radiographically is a critical step in the surgical procedure for removing impacted teeth

and the surgeon should pay particular attention to the variety of factors known to affect surgical difficulty.<sup>[1]</sup>

There are some classification methods for determining surgical difficulty in the literature. Pederson proposed a difficulty index for the removal of mandibular third molars,<sup>[2,4,7]</sup> and Pederson scale scores are based on local anatomy and radiographs,<sup>[2,10]</sup> while the modified Parant scale is used to estimate surgical difficulty postoperatively based on the surgical conditions.<sup>[2]</sup> Previous studies in the literature have set out to identify factors associated with postoperative pain, swelling, and trismus. Furthermore, surgical difficulty measured in different ways has been reported to be one of the factors related to postoperative minor complications.<sup>[2,9-15]</sup>

The objective of the present study was to investigate the effect of surgical difficulty detected using the Pederson and Parant scales, duration of surgery, age, and gender on postoperative pain, swelling, and trismus in a representative group of patients who underwent day case surgery.

## MATERIALS AND METHODS

Fifty healthy patients who had been referred to our clinic for removal of fully impacted mandibular third molars were enrolled in this study. The

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sample comprised 39 female and 11 male patients aged between 14 to 39 years. The indications for removal were orthodontic, pain, and the position of the impacted teeth. All of the patients were healthy and without serious medical alterations or blood dyscrasia. None of the patients had acute pericoronitis or severe periodontal disease at the time of the surgery. The study was conducted in agreement with the Helsinki Declaration and ethical approval was obtained from the local ethics committee (No: 291- 5879).

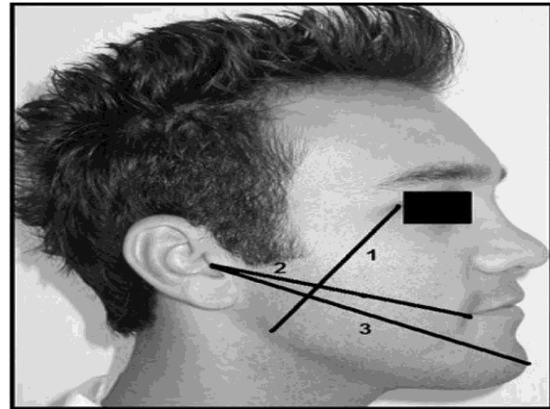
All of the surgeries were performed under local anesthesia. An incision distal to the mandibular second molar along the anterior border of the ramus, after which another incision mesial to the same molar was performed and the mucoperiosteal flap was raised. Next, osteotomy, coronal section, or root section was performed as required and the wound was closed with 3/0 silk. The sutures were removed one week after the surgery.

All patients received an antibiotic (sultamicin: 375mg every 12 hours for seven days), an analgesic (paracetamol: 500mg every eight hours for seven days), and antiseptic mouthwash (chlorhexidine 0.12%, three mouth rinses per day for six days starting the day after surgery). All interventions were performed by the same surgeon and all measurements were administered objectively by a blinded operator.

Three methods of measuring surgical difficulty for each mandibular third molar were used. Preoperatively, all impacted mandibular third molars were classified using the Pederson Scale.<sup>[2,5]</sup> After surgery, surgical difficulty was assessed using the modification of the Parant Scale by Garcia et al.<sup>[16]</sup> For each impacted third molar, the duration of the operation (from incision to the final suture) was recorded.

A Visual Analog Scale (VAS) was used to evaluate the subjective pain in postoperative 2nd and 7th days. A 10-point VAS with a scale of zero equals “no pain” to 10 “very severe pain” was used to assess pain. To define the amount of postoperative swelling, three distances were measured with a flexible ruler: the distance from lateral eye angle to the angulus mandible (1), the distance from the corner of the mouth to the tragus following the bulge of the cheek (2) and the distance from the soft tissue pogonion to the tragus (3) [Figure 1]. The measurements were recorded three times: preoperatively and on the 2nd and 7th days postoperatively. The differences between preoperative and postoperative measurements were calculated for each patient. For the evaluation of the degree of trismus, the mouth-opening distance was recorded pre-operation and on the 2nd and 7th days post-operation by measuring the interincisal distance with digital calipers [Figure 2]. Of the 50 patients, three age groups were constituted for the statistical analysis: Group 1 for 14-18 years old (n

= 17), Group 2 for 19-24 years old (n = 28) and Group 3 for 24 years old and older (n = 5).



**Figure 1: Measurements used to define the amount of postoperative swelling.**



**Figure 2: Measurement of the maximum mouth opening with a digital caliper.**

Recorded data were analyzed using the SPSS 11.0 for Windows (SPSS Inc, Chicago, IL) with statistical significance set at  $P = 0.05$ .

## RESULTS

Of the 50 patients, 39 (78%) were women and 11 (22%) were men with mean age of  $20.22 \pm 3.93$  years. The mean duration of surgery was  $16.98 \pm 8.22$  minutes (range 7-41 minutes).

In our study, the Pederson scores were not found to be a risk factor for postoperative pain (2nd day:  $p = 0.766$ , 7th day:  $p = 0.679$ ). There were no statistically significant relationships between the Parant scale (2nd day:  $p = 0.875$ , 7th day:  $p = 0.068$ ), gender (2nd day:  $p = 0.077$ , 7th day:  $p = 0.821$ ), and pain [Table 1]. There were statistically significant relationships between the age groups and 7th day postoperative pain ( $p = 0.032$ ). Statistically significant differences were found between Groups 1 and 3 and Groups 2 and 3 ( $p = 0.009$  and  $p = 0.026$ , respectively).

**Table 1: Comparison of 2nd and 7th day postoperative pain (Pearson's correlation coefficient, and the Kruskal-Wallis and Mann-Whitney U tests were used).**

PAIN			N	Mean	SD	P
Postoperative 2nd day	Pederson scale	Score 5-6	18	2,56	±1,15	,766
		Score 7-10	32	2,72	±2,44	
	Parant scale	Easy II	26	2,77	±2,25	,875
		Difficult III	24	2,54	±1,86	
	Age Groups	14-18	17	4,00	±2,74	,172
		19-24	28	3,14	±2,86	
		24-	5	5,00	±1,41	
Gender	Female	39	4,00	±2,88	,077	
	Male	11	2,27	±1,62		
Postoperative 7th day	Pederson scale	Score 5-6	18	1,28	±2,05	,679
		Score 7-10	32	,94	±1,22	
	Parant scale	Easy II	26	1,23	±1,37	,068
		Difficult III	24	,87	±1,75	
	Age Groups	14-18	17	,59	±,71	,032
		19-24	28	1,00	±1,31	
		24-	5	3,20	±2,68	
	Gender	Female	39	1,15	±1,61	,821
		Male	11	,89	±,98	

**Table 2: Comparison of 2nd and 7th day postoperative swelling (Pearson's correlation coefficient, and the Kruskal-Wallis and Mann-Whitney U tests were used)**

SWELLING			N	Mean	SD	p
Postoperative 2nd day	Pederson scale	Score 5-6	18	15,28	±9,23	,731
		Score 7-10	32	15,09	±6,83	
	Parant scale	Easy II	26	13,27	±6,26	,066
		Difficult III	24	17,21	±8,65	
	Age Groups	14-18	17	15,53	±6,82	,429
		19-24	28	13,96	±6,96	
		24-	5	20,60	±12,78	
Gender	Female	11	12,64	±5,71	,185	
	Male	39	15,87	±8,08		
Postoperative 7th day	Pederson scale	Score 5-6	18	2,67	±3,11	,550
		Score 7-10	32	1,72	±1,67	
	Parant scale	Easy II	26	2,08	±2,54	,809
		Difficult III	24	2,04	±2,07	
	Age Groups	14-18	17	2,29	±2,02	,633
		19-24	28	2,04	±2,65	
		24-	5	1,40	±0,89	
	Gender	Female	11	1,91	±2,34	,725
		Male	39	2,10	±2,32	

**Table 3: Comparison of 2nd and 7th day postoperative trismus (Pearson's correlation coefficient, and the Kruskal-Wallis and Mann-Whitney U tests were used)**

TRISMUS			N	Mean	SD	p
Postoperative 2nd day	Pederson scale	Score 5-6	18	17,57	±8,27	,724
		Score 7-10	32	16,94	±7,42	
	Parant scale	Easy II	26	17,47	±9,04	,593
		Difficult III	24	16,84	±5,99	
	Age Groups	14-18	17	19,76	±7,12	,156
		19-24	28	16,02	±8,14	
		24-	5	14,83	±4,93	
Gender	Female	11	14,04	±6,83	,085	
	Male	39	18,05	±7,73		
Postoperative 7th day	Pederson scale	Score 5-6	18	7,82	±6,17	,840
		Score 7-10	32	7,62	±6,75	
	Parant scale	Easy II	26	8,05	±6,93	,969
		Difficult III	24	7,30	±6,09	
	Age Groups	14-18	17	10,69	±6,36	,024
		19-24	28	5,64	±5,87	
		24-	5	9,00	±7,12	
	Gender	Female	11	6,90	±7,17	,824
		Male	39	7,91	±6,36	

**Table 4: Correlation between operation time and Pederson Scale, Parant Scale, pain, swelling, and trismus (Pearson's correlation coefficient).**

OPERATION TIME		Correlations	
Pederson Scale		Pearson coefficient	,259
		p	,070
Parant Scale		Pearson coefficient	,545
		p	,000
Pain	Postoperative 2nd day	Pearson coefficient	,138
		p	,338
	Postoperative 7th day	Pearson coefficient	,091
		p	,530
Swelling	Postoperative 2nd day	Pearson coefficient	,184
		p	,201
	Postoperative 7th day	Pearson coefficient	,094
		p	,518
Trismus	Postoperative 2nd day	Pearson coefficient	,107
		p	,460
	Postoperative 7th day	Pearson coefficient	,335
		p	,017

The results in [Table 2] show that the Pederson scale scores (2nd day:  $p = 0.731$ , 7th day:  $p = 0.550$ ), the Parant scale scores (2nd day:  $p = 0.066$ , 7th day:  $p = 0.809$ ), and age (2nd day:  $p = 0.429$ , 7th day:  $p = 0.633$ ) were not risk factors for postoperative swelling. Although the recorded measurements for swelling were high for females, the relationship with gender was not statistically significant (2nd day:  $p = 0.185$ , 7th day:  $p = 0.725$ ) [Table 2].

The results in [Table 3] indicate that the Pederson scale scores (2nd day:  $p = 0.724$ , 7th day  $p = 0.840$ ), the Parant scale scores (2nd day:  $p = 0.593$ , 7th day:  $p = 0.969$ ), and gender (2nd day:  $p = 0.085$ , 7th day:  $p = 0.824$ ) were not risk factors for postoperative trismus. However, we did find a statistically significant relationship between age and trismus on the 7th day post-operation ( $p = 0.024$ ), and a statistically significant difference was determined between Groups 1 and 2 ( $p = 0.008$ ) [Table 3].

The relationships between the duration of surgery, Pederson scale, Parant scale, and postoperative complications were analyzed using Pearson's correlation coefficient. We found that the relationship between the duration of surgery and Parant scale was statistically significant ( $p = 0.000$ ,  $r = 0.545$ ), but increased Pederson scale scores did not affect the duration of surgery ( $p = 0.070$ ,  $r = 0.259$ ). The relationship between operation time and trismus on the 7th day post-operation was statistically significant ( $p = 0.017$ ,  $r = 0,335$ ) [Table 4]. The results showed that the duration of surgery was not a risk factor for postoperative pain and swelling.

## DISCUSSION

Pain, swelling, and trismus are generally observed in the early postoperative period after mandibular third molar surgery.<sup>[9]</sup> Moreover, it is known that postoperative inflammatory reactions reach maximum level 2 days after surgery and generally

wears off after one week.<sup>[17]</sup> The removal of impacted third molars can affect patients' quality of life negatively. Gender, age, ethnic group, surgical difficulty, the experience of the surgeon, the patient's medical condition, and smoking may increase postoperative conditions,<sup>[6,7,12,18]</sup> and the aim of many studies has been to reduce these after oral and maxillofacial surgery.

Our study included several limitations. First, we had a small sample size, and so further trials should be designed with larger numbers of participants to investigate the relationships between surgical difficulty during mandibular third molar surgery and postoperative complications. Second, as pain is a subjective criterion, individual variation and other psychological factors may affect the results of pain scales.

A variety of classification systems have been developed to aid in the determination of surgical difficulty.<sup>[1]</sup> The Pederson scale is widely cited in oral and maxillofacial surgical texts as a useful way of predicting the difficulty of impacted third molar surgery preoperatively,<sup>[5]</sup> while the Parant scale is used for classification after surgery and cannot be used for preoperative evaluation.<sup>[2]</sup> Freitas et al.<sup>[5]</sup> evaluated the value of the Pederson scale with reference to the postoperative evaluation of surgical difficulty using a modified Parant scale. The authors reported that the Pederson scale had poor sensitivity: over 75% of difficult extractions were not identified, but the modified Parant scale was reliable, consistent with measuring operative difficulty, and an appropriate gold standard. Freitas et al.<sup>[5]</sup> and Yuasa et al.<sup>[2]</sup> reported that the scales for predicting surgical difficulty should include root anatomy, but detection of abnormal root curvature on a panoramic radiograph is difficult. Santamaria et al.<sup>[19]</sup> reported that the prediction of surgical difficulty should be assessed by only the tooth angulation, depth of impaction, follicle size, relationship with the 2nd molar, position relative to the ramus, and the duration of the surgery. Some

authors believe that surgical difficulty cannot be reliably estimated before surgery on the basis of radiographs but rather must be determined during surgery.<sup>[5,7]</sup> In these studies, both the Pederson and Parant scales were used and the duration of surgery was recorded for each impacted third molar. As a general rule, a more severe and time-consuming surgical procedure results in more troublesome and prolonged postoperative recovery.<sup>[1]</sup> According to our results, the relationships between the Pederson scale scores and the other variables (duration of the surgery, postoperative pain, swelling, and trismus) were not statistically significant. It can be said that the Pederson scale did not show the real surgical difficulty and although the relationship between the Parant scale and the operation time was statistically significant, the scores were not risk factors for postoperative pain, trismus, and swelling. The duration of surgery increased the trismus on the 7th day post-operation.

The surgeon's experience is a factor that can influence the degree of any complications after third molar surgery.<sup>[1,20]</sup> Susarla et al.<sup>[4]</sup> reported that the surgeon's experience is the most important factor for postoperative complications, which the authors supported with evidence that the surgeons' experience influences the duration of the surgery, which affects the degree of postoperative complications. In the present study, all interventions were performed by the same surgeon with eight years surgical experience.

The duration of the surgery depends on various factors: age of the patient, surgical difficulty, surgeon's experience, and the surgical technique,<sup>[1,4,5,15,21,22]</sup> and it is generally regarded as the gold standard for measurement of intraoperative difficulty in mandibular third molar surgery.<sup>[15,23,24]</sup> The duration of surgery has not been shown to correlate with postoperative swelling and trismus, but the most important determinant of the amount of postoperative pain is the duration of the surgery.<sup>[1]</sup> In disagreement with this, some authors have stated that only the duration of the surgery cannot be a risk indicator for postoperative complications.<sup>[12,15]</sup> In the present study, the mean duration of surgery was  $16.98 \pm 8.22$  minutes (range 7- 41 minutes), and there was no statistically significant relationship between operation time and postoperative pain and swelling. The results showed that prolonged duration of surgery increased trismus on the 7th day post-operation, thus it might have increased both the risk of damaging the adjacent structures and infection.

Postoperative pain is an expected complication after third molar surgery. Capuzzi et al.<sup>[25]</sup> reported that gender, age, and the experience of the surgeon can influence the degree of pain and swelling. The authors found that other variables had no influence on the degree of pain and swelling. Some authors reported that age was not predictive of pain and

other factors that might affect it, including a history of pericoronitis, poor oral hygiene, and contraceptive use.<sup>[7,9,26,27]</sup> Lago-Mendez et al.<sup>[9]</sup> reported that surgical difficulty as evaluated on their postoperatively applied 4-class scale was positively correlated with postoperative pain because tissue damage is generally more extensive at each increased level of surgical difficulty and pain is due to tissue damage. Grossi et al.<sup>[3]</sup> and Benediktsdottir et al.<sup>[15]</sup> reported that gender is a strong risk indicator of pain. In our study, the relationship observed between age and postoperative pain was statistically significant only on the 7th day post-operation, but gender was not found to be a risk factor. In contrast, other studies have found that the severity of postoperative pain can vary from patient to patient and does not appear to be related to surgical difficulty.<sup>[28,29]</sup> Lago-Mendez et al.<sup>[9]</sup> reported that increased surgical difficulty increased the postoperative pain on the 2nd day post-operation, but according to the Parant scale (easy I, easy II, difficult III, and difficult IV and needs the reflection of the mucoperiosteal flap), influenced the postoperative pain when more than easy I. In the present study, all of the third molars were impacted and according to the Parant scale, the measured surgical difficulties were easy II and difficult III.

Another postoperative complication expected after third molar surgery is swelling. Kim et al.<sup>[8]</sup> reported that the variables that showed a statistically significant relationship with postoperative swelling were age, the degree of impaction, and the duration of the surgery at the 7th day post-operation. The authors also showed that the degree of impaction and duration of surgery was related to postoperative swelling. Yuasa et al.<sup>[30]</sup> reported that postoperative swelling was also associated with the width of the ramus, and that age is an important variable in postoperative swelling due to different vascular permeability in elder patients. The authors showed severe swelling with easier extractions associated with a wide ramus. Osunde et al.<sup>[7]</sup> reported that age was found to have variable effects on postoperative swelling at day 7. In this study, we did not find statistically significant relationships between age, gender, operation time, or Pederson and Parant scores and swelling.

Trismus is a normal and expected outcome following third molar surgery. Kim et al.<sup>[8]</sup> reported that reduced mouth opening of over 10 mm is significantly associated with the degree of impaction. As deeply impacted teeth need wider flap reflection for extraction, this may increase the risk of damaging to adjacent muscles. Grossi et al.<sup>[3]</sup> reported that older patients and females are at greater risk of severe trismus after third molar surgery. In this study, we found a statistically significant relationship between duration of surgery

and trismus, and age and trismus on the 7th day post-operation. There were no statistically significant relationships between gender or Pederson and Parant scores and trismus.

## CONCLUSION

Careful preoperative analysis of potential extraction difficulties and correct surgical planning can reduce intra- and postoperative complications of the impacted third molar surgeries. Although there are many factors that increase the degree of surgical difficulty, not all of these are the cause of postoperative complications. Further studies should be carried out on larger populations.

### Acknowledgment

This work was supported by a research grant from the Süleyman Demirel University Scientific Research Projects Coordination Department, Project Number: 1417D-06.

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**How to cite this article:** Aksoy MC, Tuzum MS, Baykul T. Relationships between Surgical Difficulty and Postoperative Complications in Mandibular Third Molar Surgery. Ann. Int. Med. Den. Res. 2018; 4(3):DE11-DE17.

**Source of Support:** Nil, **Conflict of Interest:** None declared