

# CORRELATION BETWEEN THE POSITION OF THE IMPACTED THIRD MANDIBULAR MOLAR AND THE POSTOPERATIVE COMPLICATIONS – A CLINICAL AND RADIOGRAPHIC EVALUATION

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## Abstract

Third molars are the last teeth to erupt in oral cavity, in most cases they are impacted, because of their inappropriate position. The aim of this study is to analyze the correlation between the position of the impacted third mandibular molar and the postoperative complications after surgical extraction of the tooth. The sample of the study consisted of a total of 80 patients, of both sexes, diagnosed with fully or partially impacted third mandibular molars, who were followed up after the surgery for a three-month period. For all participants in the research panoramic radiography was taken before the intervention, to analyze the angulation, the depth of impaction and the relation to the covering tissue of the impacted third mandibular molar. Postoperative complications were recorded and analyzed after surgical extraction of the impacted third mandibular molar. The most manifested postoperative complications after the impacted third mandibular molar surgery were trismus, swelling and dry socket. All the pathologies were associated with the tooth position. Trismus was most common for the mesioangular position of impacted third mandibular molar, class III B. Swelling occurs predominantly in the impacted third mandibular molars with mesioangular position, class II B. Dry socket was more prevalent in impacted third mandibular molars with vertical position, class II A. The position of the impacted third mandibular molar has a significant correlation with the development of the postoperative complications after the surgical tooth extraction.

*Keywords:* Impaction, Mandibular third molar, Position, Trismus, Swelling, Dry socket, Panoramic radiography.

## 1. Introduction

Oral diseases and pathologies related to teeth, among which, the pathologies and complications related to the impacted teeth occupy an important place in the contemporary literature

The term "impacted tooth" means a completely or partially non-erupted tooth, which is located in an inappropriate position related to the adjacent tooth, bone or soft tissue, so that its further eruption is difficult, even impossible, according to its anatomical position. [Giulia P. et al., 2021]. Third molars appear to be impacted most frequently, compared to other groups of teeth. They are the last to join the tooth sequence and, at the same time, show a great variability in shape, size, placement, root development and the path of eruption [Alfadil, L., Almajed, E. (2020); Verma A. et al., 2017]. Many studies have shown that the impaction of the third molar is influenced by several factors, such as: insufficient space for eruption in the region of the third molar, angulation of the third molar, its ectopic position, obstruction of the eruption path, late mineralization of third molar and other factors, such as gender, race, socioeconomic differences, genetic and endocrinological factors [Kaur R. et al., 2016].

Numerous studies in the dental literature discuss the pathologies related to the position of the impacted third molars. These teeth have a predisposition to cause various pathologies, such as: pericoronitis, periodontal diseases of the second molar, orofacial infections, caries, resorption of the root of the adjacent tooth, cystic changes, changes in bone structure, problems with the temporomandibular joint etc.

The pathologies that are a consequence of the severe or impossible eruption of the third impacted molars, and their symptoms, are an indication for the extraction of these teeth. However, often the oral surgery intervention to extract the impacted third molar is associated with complications of a different character. Çetin K. et al. (2013), in a study, shows that pain, swelling, trismus, hemorrhage, and dry socket are symptoms that accompany almost every extraction of the third impacted molar. The morbidity increases with the age of the patient, the position of the tooth, and the duration of the surgical procedure.

Monaco G. et al. (2022) and Rezai F. et al. (2020) point out that complications associated with surgical extraction of an impacted tooth can be caused by local or general factors, such as tooth position, patient age, medical condition, surgical instruments used during surgery, etc. More common complications are: mandibular nerve injury, followed by paraesthesia, infection or hemorrhage, trismus, iatrogenic injury to the adjacent second molar, and mandibular fracture occurring very rarely.

According to Elitsa G. Deliverska and Milena Petkova (2016), while evaluating the postoperative complications regarding the width and depth of the impaction, pain, and swelling were common in class III, position A (37.5%) followed by class III, position B (20%); dry socket was common in class III position A, IA and IIA that was 12.5%, 5%, and 4.8% respectively; trismus occurred more in Class III position B (20%), Class III position A (12.5%) and Class I position B(6.8%) while paresthesia was less common and occurred in only 2 patients (0.7%)

To determine the correct diagnosis, it is very important to define the location of the impacted third mandibular molar, and most of the research in the world literature is based on the classification of the impacted molars such as:

- Winter classification, which defines the deviation in the eruption of the third impacted molar from the normal position of the tooth in the dental array, ie the angle formed between the average longitudinal axis of the second and third mandibular molar [ Rezai F et al., 2020].
- Pell and Gregory classification, determines the relationship between the third impacted molar with the ramus mandibulae and the adjacent tooth, ie the second molar [Leila Khojastepour et al., 2019].
- Pell and Gregory classification, determines the depth of the impacted molar related to the occlusal plane [Leila Khojastepour et al., 2019].

Depending on the location, the pathologies related to the impacted third molars also vary. In clinical practice, radiography imaging has an important role in determining the correct diagnosis. In addition to giving us a clear approach to the position of the impacted tooth and its relationship to the surrounding tissues, it gives us a clear picture of other pathological changes in the jaw bone.

Santhosh K. and Indhulekha V. (2017), in their research, point out pain, trismus, and postoperative swelling as the most common postoperative complications during surgical extraction of the impacted third mandibular molar. Postoperative swelling occurs immediately after the tooth extraction, reaches its maximum two to three days after the intervention, and is absorbed after a week. Trismus occurs due to trauma caused to the masticatory muscles, which causes inflammation of the masticatory muscles. As for the pain, it starts with the application of anesthesia and becomes strongest 6 to 12 hours after the oral surgery.

A retrospective study by Devorah Schwartz-Arad et al. (2018), which included 463 patients diagnosed with impacted third mandibular molars, aged 13 to 75 years, and extracted 665 third mandibular molars, showed that the prevalence of postoperative complications was 17%. From the general percentage, dry socket showed the highest incidence with 11.6%, while smoking patients were predisposed to dry socket with a total of 67.3% of cases. She concluded that postoperative complications increase with age, level of

impaction, extraction site, and smoking

Khan A. et al. (2010) analyzing the postoperative complications regarding the mesiodistal diameter of the affected third mandibular molar and the depth, concluded that postoperative swelling and dry socket were significantly present in class III, position A, while trismus was most common for class III and B position.

## **2. Material and methods**

The study sample consisted of 80 patients diagnosed with impacted third mandibular molar. The diagnosis was defined according to the clinical examination and panoramic radiography imaging of the patients, performed in the Polyclinic of Specialist Consultative Activity "Alba Ortodont", in Tetovo, under scientific supervision from the Clinic for Oral Surgery, PHI University Dental Clinical Center "St. Panteleimon", Skopje, in the period 2019 and 2020. Surgical extraction of the impacted mandibular third molar in all subjects was performed by the same oral surgeon.

The selection of patients in the research sample was limited by certain criteria for patient selection, i.e. inclusion and exclusion from the study.

Inclusion criteria of the study: patients with permanent dentition, impacted third mandibular molars, partially impacted third mandibular molar, subjective and objective complaints related to impacted third mandibular molar, patients in good health conditions, smoking patients.

Exclusion criteria of the study: pregnancy, breastfeeding, and patients with acute and chronic diseases.

The research procedure in the patients who were part of the study covered several consecutive phases: history, clinical examination, assessment of the impacted tooth according to clinical and radiographic evaluation, diagnosis and prognosis, patient preparation, management of the impacted tooth, and assessment of complications.

First, in the methodology for solving the problem with the impacted third mandibular molar, the classification of the impacted molars was made, so that the relationship of the tooth with the ramus mandible and the second mandibular molar was determined according to the Pell and Gregory classification, while the angulation of the impacted mandibular molar was based on Winter classification. The depth of the impacted mandibular molar related to the occlusal plane was also determined according to the appropriate classification.

A clinical and radiographic evaluation of the tooth was performed. After the surgical extraction, the complications were analyzed and listed.

## **3. Statistical analysis**

The data obtained during the research were statistically processed using SPSS software package, version 22.0 for Windows (SPSS, Chicago, IL, USA).

The analysis of the attributive (qualitative) series was done by determining the coefficient of relations, proportions and rates, and they were presented as absolute and relative numbers. Numerical (quantitative) series were analyzed using the measures of central tendency (average, median, minimum values, maximum values, interactive ranks), as well as by measures of dispersion (standard deviation).

Pearson Chi square test, Yates corrected, Fischer exact test and Fisher Freeman Halton exact test were used to determine the association between certain attribute traits.

Risk factors were quantified using probability ratios (Oddratio - OR) and confidence intervals (CI). Difference test was used to compare the proportions.

A significance level of  $p < 0.05$  was used for all applied analyzes to determine statistical significance.

## 4. Results

The sample of the study consisted of a sample of 80 patients selected by random sampling method according to pre-set inclusion and exclusion criteria. All patients included in the study had an impacted third mandibular molar, with an indication for its extraction. The relationship between the position of the extracted third mandibular molar and postoperative complications was investigated. The clinical condition of the patients in the sample was analyzed at three-time points (first day, 1 week and 3 months after the surgery).

The obtained results represent a compilation of anamnestic data, clinical findings, assessment based on panoramic radiography, recordings made before and after surgical extraction of the impacted third mandibular molar, intraoperative and postoperative assessments, and an independent observation of the researcher.

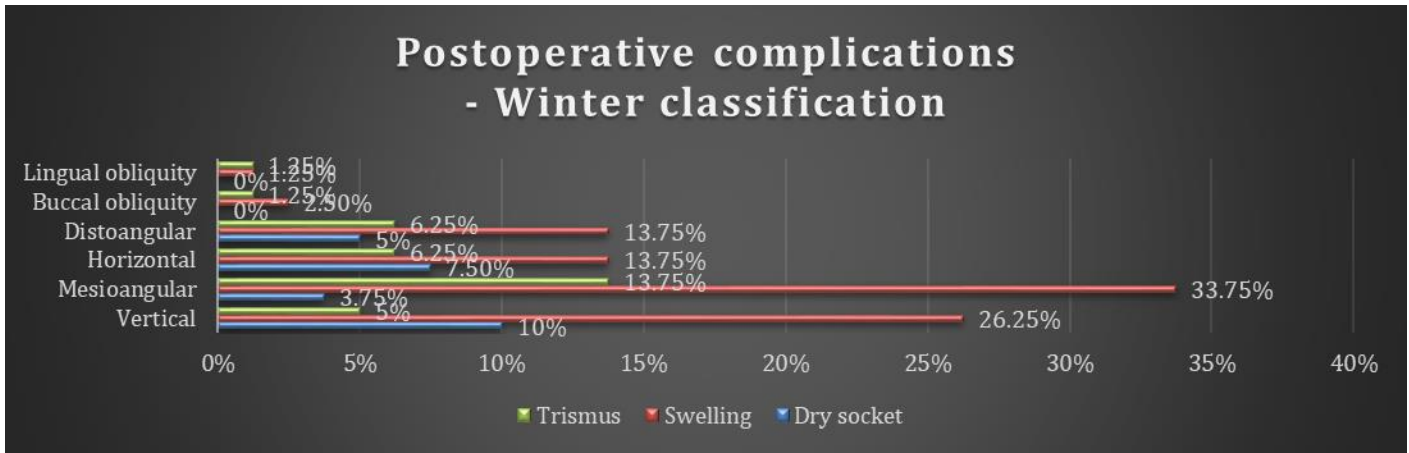
### 4.1 The correlation between the postoperative complications and the position of the third mandibular molar according to Winter classification

In this section, an analysis was made according to Winter classifications for the angulation of the impacted mandibular third molar and the postoperative complications (trismus, swelling and, dry socket) which were the most manifested. (Table 1 and Graph.1)

**Table 1:** Correlation of the third mandibular molar position according to Winter classification with the postoperative complications

Postoperative complications		Winter classification ((total of 80 cases arranged by angulation of the third molar)						<sup>1</sup> p
		1 N=26	2 N=27	3 N=11	4 N=13	5 N=2	6 N=1	
Trismus	N	4	11	10	5	1	1	Winter (1-5); p=0,001*
	%	5%	13.75%	12.5%	6.25%	1.25%	1.25%	
Swelling	N	21	27	11	11	2	1	Winter (1,4); p=0,768
	%	26.25%	33.75%	13.75%	13.75%	2.5%	1.25%	
Dry socket	N	8	3	6	4	0	0	Winter (1-4); p=0,042*
	%	10%	3.75%	7.5%	5%	0%	0%	
		<sup>1</sup> Fisher Feaman Halton exact test				*significant for p<0,05		
<sup>2</sup> Classification: 1-vertical, 2-mesioangular, 3-horizontal, 4-distoangular, 5 – buccal obliquity, 6-lingual obliquity								

**Graph 1.** Correlation of the third mandibular molar position according to Winter classification with the postoperative complications



**Trismus** - The highest percentage of trismus was recorded in patients with the mesioangular position of the third mandibular molar, in 11 (13.75%) patients, followed by the horizontal position of the third molar, in 10 (12.5%) patients. In patients with vertical and distangular positions, trismus was present consistently 4 (5%) vs. 5 (6.25%), to end with the same 1.25% for buccal and lingual obliquity. For  $p < 0.05$ , a significant association was found between the trismus finding and the Winter classification (Fisher Freeman Halton exact test:  $p = 0.001$ ) (Tab.1 and Graph.1).

**Swelling** - Swelling occurred in 27 (33.75%) patients with the mesioangular position of the third molar, followed by 21 (26.25%) patients with a vertical position of the tooth. Horizontal and distoangular positions were presented with the same percentage (13.75%). And the lowest values go for buccal and lingual obliquity of the third molar, consistently 2 (2.5%) vs. 1 (1.25%). For  $p > 0.05$ , there was a significant association between the occurrence of swelling and the mesioangular and vertical position of the third mandibular molar, according to Winter classification (Fisher Freeman Halton exact test:  $p = 0.768$ ) (Tab.1 and Graph.1).

**Dry socket** - the dry socket was not present in patients with buccal and lingual obliquity of the third mandibular molar. For  $p < 0.05$ , a significant association was established between the occurrence of dry socket and the classifications according to Winter (Fisher Freeman Halton exact test:  $p = 0.042$ ) in addition to its significantly higher presence in the vertical position of the third molar in 8 (10%) patients, followed by horizontal position 6 (7.5%), distoangular position 4 (5%) and mesioangular position 3 (3.75%) (Tab.1 and Graph 1).

*4.2 The correlation between the postoperative complications and the position of the third mandibular molar according to Pell and Gregory's classification*

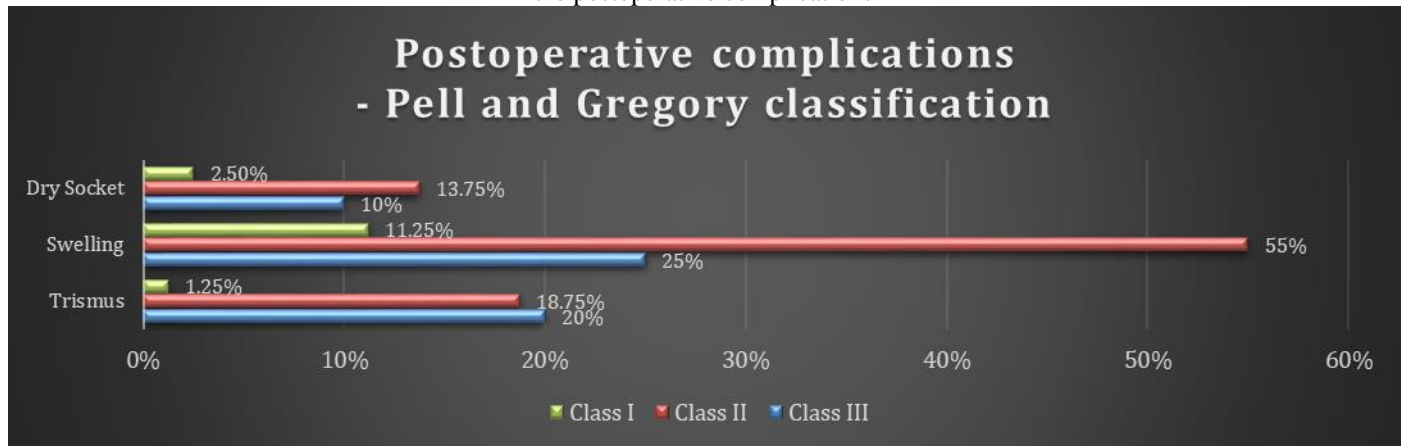
In this section, an analysis was made according to Pell and Gregory's classifications for the position of the impacted mandibular third molar and postoperative complications (trismus, swelling, and dry socket) which were the most manifested. (Table 2 and Graph.2) (Table 3 and Graph.3)

**Tab.2.** Correlation of the third mandibular molar position according to Pell and Gregory classification with the postoperative complications

Parameters (total of 80 cases arranged by class I, II and III position of the third molar)	Pell and Gregory classification			P
	I class N=11 (13.75%)	II class N=49 (61.25%)	III class N=20 (25%)	
<b>Postoperative parameters</b>				

<b>Trismus</b>	<b>N</b>	1	15	16	<sup>1</sup> p=0,0001
	<b>%</b>	1.25%	18.75%	20%	
<b>Swelling</b>	<b>N</b>	9	44	20	X <sup>2</sup> =0,555; df=1; <sup>2</sup> p=0,4564
	<b>%</b>	11.25%	55%	25%	
<b>Dry socket</b>	<b>N</b>	2	11	8	<sup>1</sup> p=0,261
	<b>%</b>	2.5%	13.75%	10%	
		<sup>1</sup> Fisher Feaman Halton exact test	<sup>2</sup> Pearson Chi-square test	*significant for p<0,05	

**Graph 2.** Correlation of the third mandibular molar position according to Pell and Gregory classification with the postoperative complications

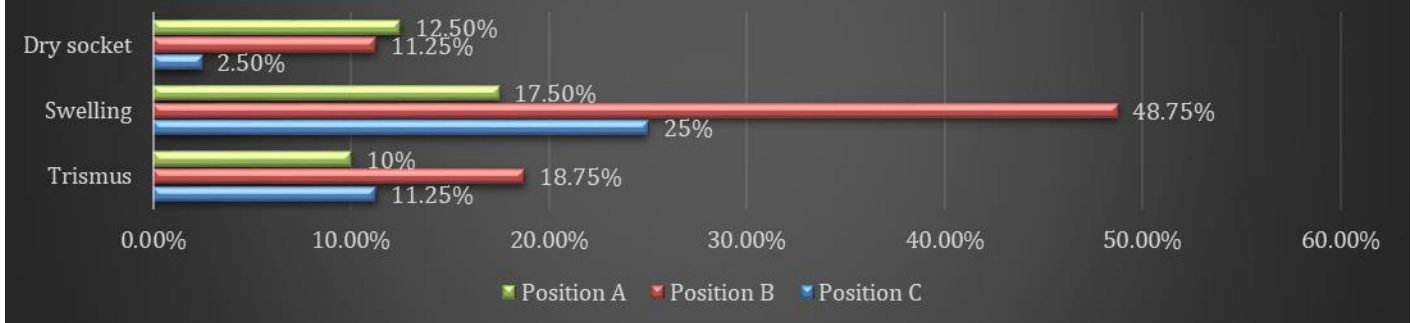


**Tab.3, Graph 3.** Correlation of the third mandibular molar bone depth according to Pell and Gregory classification with the postoperative complications

<b>Parameters</b> (total of 80 cases arranged by position A, B and C of the third molar)	<b>Pell and Gregory classification according to depth</b>			<b>P</b>	
	<b>Position A</b> N=19 (23.75%)	<b>Position B</b> N=41 (51.25%)	<b>Position C</b> N=20 (25%)		
<b>Postoperative parameters</b>					
<b>Trismus</b>	<b>N</b>	8	15	9	X <sup>2</sup> =0,443; df=2; <sup>2</sup> p=0,8015
	<b>%</b>	10%	18.75%	11.25%	
<b>Swelling</b>	<b>N</b>	14	39	20	<sup>1</sup> p=0,0161
	<b>%</b>	17.5%	48.75%	25%	
<b>Dry socket</b>	<b>N</b>	10	9	2	<sup>1</sup> p=0,007
	<b>%</b>	12.5%	11.25%	2.5%	
		<sup>1</sup> Fisher Feaman Halton exact test	<sup>2</sup> Pearson Chi-square test	* significant for p<0,05	

**Graph 3.** Correlation of the third mandibular molar bone depth according to Pell & Gregory classification with postoperative complications

## Postoperative complications - Pell and Gregory classification



**Trismus** - the analysis indicated the highest proportion of postoperative trismus in patients of class III - 16 (20%), followed by class II - 15 (18.75%) and less in class I in 1 (1.25%) patient. For  $p < 0.05$ , a significant association was found between postoperative trismus and Pell and Gregory classification (Fisher Freeman Halton exact test:  $p = 0.0001$ ). According to the depth of mandibular molar in bone, the analysis indicated the highest proportion of postoperative trismus in patients with Position B-15 (18.75%), followed by Position C-9 (11.25%) and Position A-8 (10%). For  $p > 0.05$ , there was no significant association between postoperative trismus and the Pell and Gregory classification for third molar bone depth (Pearson Chi-square test = 0.443;  $df = 2$ ;  $p = 0.8015$ ).

**Swelling** - in the sample, the swelling was present in all class III patients 20 (25%), the highest percentage was noted in class II - 44 (55%), and the lowest in class I - 9 (11.25%). For  $p > 0.05$ , there was a significant association between swelling and belonging to class I, II, or III, according to the Pell and Gregory classifications (Pearson Chi-square test = 0.555;  $df = 1$ ;  $p = 0.4564$ ). Referring to the depth of the third molar in bone, the swelling was present in all patients with Position C, 20 (25%) followed by 39 (48.75%) of those with Position B, and 14 (17.5%) with Position A. For  $p < 0.05$ , there was a significant association between postoperative swelling and belonging to Position A, B, or C according to Pell and Gregory for third molar bone depth (Fisher exact test:  $p = 0.0161$ ).

**Dry socket** - dry socket in the sample was present in 2 (2.5%) patients in class I, 11 (13.75%) in class II, and 8 (10%) in class III. For  $p > 0.05$ , there was no significant association between the postoperative dry socket and the classification according to Pell and Gregory (Fisher Freeman Halton exact test:  $p = 0.261$ ). According to a bone depth of the third mandibular molar, in the sample, the dry socket was present in 10 (12.5%) of patients with Position A, in 9 (11.25%) with Position B, and in 2 (2.5%) with Position C. For  $p < 0.05$ , there was a significant association between the postoperative dry socket and the Pell and Gregory classification for the third mandibular molar bone depth (Fisher Freeman Halton exact test:  $p = 0.007$ ).

### 5. Discussion and conclusion

Pathologies related to the third impacted molars end with the extraction of these teeth by surgery, which is often a complex procedure and can cause intraoperative or postoperative complications. When it comes to postoperative complications in most of our patients, the presence of trismus, postoperative swelling, and dry socket associated with the position of the affected third mandibular molar has been reported.

Trismus is a medical condition in which the normal movement of the jaw is reduced, as a result of spasms of the masticatory muscles [Monisha N. et al.,2018]. This non-physiological condition is expected after the surgical extraction of the impacted third mandibular molar, so in our research it was statistically significant

at the mesioangular position, class III and position B.

Postoperative swelling is an expected tissue reaction after manipulation and trauma caused by surgical extraction of the impacted third mandibular molar. This physiological phenomenon reaches its maximum within 48 hours postoperatively and resolves by the fourth day [Ayaz H. et al., 2012]. In all our patients with postoperative swelling, the correlation of this phenomenon with the mesioangular position of impacted third mandibular molar, class II and B position was significant.

Regarding the correlation of the third mandibular molar position with dry socket, the presence of this complication more significant was in the impacted third mandibular molars with vertical position, class II and position A.

The relationship between the position of the third impacted molar and postoperative complications was also studied by Elitsa G. Deliverska and Milena Petkova (2016) who evaluated the postoperative complications regarding the width and depth of the impaction. Contrary to the results of our research they found out that pain and swelling was common in class III, position A; dry socket was common in class III, position A; trismus occurred more often in Class III, position B (20%)., and this is the one parameter matching our research results.

Contrary to our results, Khan A. et al. (2010), analyzing the postoperative complications regarding the mesiodistal diameter of the affected third mandibular molar and the depth, concluded that postoperative swelling and dry socket were significantly present in class III, position A. Meanwhile trismus was most common for class III and B position, which matches with the results of our study.

The results obtained from our research, lead us to the conclusion that the position of the impacted third mandibular molar affects the occurrence of the postoperative complications.

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