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Radiography Study of Extraction Difficulty at Lower Third Molar Impacted Using The Pederson Assessment System

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ABSTRACT

The mandibular third molar (38/48) is the tooth with the highest prevalence of impact. Impacted teeth 38 and 48 often cause pathological complications that require extraction; and for that it is very important considering the level of difficulty. This study aims to determine the level of difficulty of extraction of the impacted third molar tooth through panoramic radiography using the Pederson Scoring System (PSS). This observational study involved 91 panoramic radiographs from patients > 20 years old with lower third molar teeth that had an impact at RSGMP University of Jember, patient data on radiographs is complete, coverage (region of interest / ROI) is sufficient and visual quality is good. The level of extraction difficulty was assessed using PSS, and categorized into low, medium and high. The data obtained were analyzed descriptively and inferentially using the Chi Square test(α = 0,05). This study used 144 impacted lower third molars from 91 patients; 61 teeth from male and 83 teeth from females; 59.34% of patients were bilateral and 40.65% were unilateral; 73 teeth (50.69%) occurred in the right region and 71 teeth (49.31%) occurred in the left region. Based on PSS index, 4.86% had a low risk of extraction difficulty, 65.28% moderate and 29.86% high. The Chi-Square test found no relationship between gender and the level of difficulty in extracting impacted lower third molars ($p<0.05$). The conclusion of this study is that the level of difficulty in extracting mandibular third molars at RSGMP Jember University is mostly (65%) moderate difficulty.

Keyword : extraction difficulty, impacted tooth, lower third molar, panoramic radiography, Pederson Scoring System

Introduction

Impacted teeth are teeth that fail to erupt in the jaw arch within the estimated time period, according to their eruption schedule [1]. Impacted teeth can be caused by factors related to the adjacent teeth, a dense layer of bone or thick soft tissue above it which prevents the tooth from erupting, and the most common cause is an insufficient dental arch length.

The occurrence of impacted teeth that are often found in permanent teeth are lower and upper third molars, upper canines, lower premolars and incisors. The prevalence of impacted teeth is increasing along with the development of time. The lower third molar is the tooth with the highest prevalence of impaction [2][3]; 16-73% in young adults [4], other studies report 16.7% and 68.6% worldwide [5]. Alfadil and Almajed's research in Saudi Arabia in 2020 found impaction in the lower jaw (third molar) of 58.5% and the upper jaw 41.5%. Among the causes is that the lower third molar is the last tooth to erupt [6].

Impacted tooth extraction (*odontectomy*) is a surgical procedure that is routinely performed. Impacted teeth have many variations in their position, angulation, root shape, relationship with other structures around them, for example the mandibular canal. This variation means that the extraction procedure is not easy and carries the risk

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of complications such as swelling, pain, dry socket, and injury to the inferior alveolar nerve[7].

Odontectomy of the lower third molar and other impacted teeth is performed for prophylactic reasons, orthodontic and prosthetic treatment or due to accompanying pathological conditions; such as odontogenic infection (pericoronitis, dental caries), trismus, temporomandibular joint disorders and interstitial infections. Impacted tooth extraction is also associated with postoperative complications such as swelling, pain, limited mouth opening, dry socket, and inferior alveolar nerve injury [7]. Due to the many variations in the conditions of impacted lower third molars and the complexity of the important anatomical structures around them, the extraction of lower third molars is not easy. On that basis, the analysis of the difficulty of extracting impacted lower third molars is very important to be done before *odontectomy*.

Assessment of the difficulty of the *odontectomy* procedure, especially impacted mandibular third molars, can be done using the *odontectomy* difficulty index, for example by using the Pederson Scoring System. The Pederson Scoring System is an index for assessing the difficulty of extracting impacted mandibular third molars that is widely used and easy to use. In general, PSS makes predictions about the difficulty of *odontectomy* using 3 criteria, namely the position (angulation) of the impacted tooth, the depth of the impacted tooth, and the relationship of the impacted tooth to the mandibular ramus. The difficulty score for extracting impacted teeth can be grouped into routine/low, moderate and difficult [7][8][9].

Table 1. Level of difficulty of extracting impacted lower third molars based on the Pederson Scoring System

Criteria	Score
Position of the third molar	
• Mesioangular	1
• Horizontal	2
• Vertical	3
• Distoangular	4
Relative depth	
• Impacted tooth is at the level of the occlusal plane	1
• Impacted tooth is between the occlusal plane and the cervical line of the second molar	2
• Impacted tooth is below the cervical line of the second molar	3
The relation with the ramus	
• Sufficient space between the distal wall of the second molar and the ramus	1
• Space between the ramus and second molar is smaller than the mesiodistal width of the impacted molar	2
• The impacted tooth is in the ramus	3
The difficulty level of impaction can be defined as	
• Routine	3 - 4
• Moderate	5 - 6
• Difficult	7 - 10

Data on the description of the prediction of the level of difficulty of impacted mandibular third molar odontectomy has been conducted, but in the Jember area it has never been conducted, and if it has been conducted, the data still needs to be updated continuously. This study aims to provide an overview of the prediction and analysis of the level of difficulty of impacted mandibular third molar tooth extraction using panoramic radiographs. This study can create a comprehensive predictive and analytical framework using panoramic radiography to assess the difficulty of extracting impacted mandibular third molars, especially in the population in Jember and surrounding areas.

Methods

This analytical observational research has received ethical approval from the health research ethics commission, Faculty of Dentistry, Jember University with no. 2681/UN25.8/KEPK/DL/2024. Determining the sample using a total sampling technique, 91 radiographs were obtained that met the inclusion criteria from 158 panoramic radiographs from patients in 2022-2023 at the RSGMP Radiology Laboratory, Jember University. Inclusion criteria include: 38 or 48 impacted teeth, radiographs with complete patient data, male or female patients and aged 20 years or older, and good visual quality of radiographs, especially coverage in the region of interest (ROI).

The research variable was the level of difficulty in extracting impacted mandibular third molars. The research instrument is the Pederson Scoring System (PSS). The degree of difficulty in extracting impacted teeth is grouped into low, medium and high difficulty. The data obtained were

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analyzed descriptively and inferentially using the Chi Square test(α = 0,05).

Results and Discussion

Table 2. Sample distribution based on gender and age

Characteristics	Total	
	n	%
Gender		
Male	37	40,66
Female	54	59,34
N	91	100
Age		
20 – 30	65	71,43
31 – 40	18	20
41 – 50	4	4,4
>50	4	4,4
N	91	100

Table 3. Distribution of impacted lower third molars based on gender and region

Gender	Impaksi [n/(%)]		
	Right	Left	Total
Male	30 (49,18)	31 (50,82)	61 (42,36)
Female	43 (51,81)	40 (48,19)	83 (57,64)
Total	73 (50,69)	71 (49,31)	144 (100)
Asymp. Sig.			0,133

The data in table 3 shows that this study found 144 impacted lower third molars. Impacted lower third molars were more common in women (57.64%) than in men (42.36%). The incidence of impacted lower third molars was almost the same between the right and left regions; both in men and women.The Chi-Square test found that there was no relationship between gender and the incidence of mandibular third molar impaction (p>0.05).

Table 4. Distribution of impacted lower third molars based on Uni or Bilateral

Gender	Impacted lower third molar [n/(%)]		
	Unilateral	Bilateral	Total
Laki laki	10	26	36
Perempuan	27	28	55
Total	37 (40,65)	54 (59,3)	91
Asymp.Sig.			0,043

The data in Table 4 shows that bilateral lower third molar impaction occurs more often (59.34%) than unilateral (40.65); both in men and women. The results of the Chi-Square test found a significant relationship between gender and the occurrence of uni or bilateral lower third molar impaction (p <0.05). The data above also shows that the difference in unilateral and bilateral impaction occurs more often in men, while in women the occurrence is almost the same.

Table 5. Level of difficulty of extraction of impacted lower third molar teeth using the Pederson Scoring System (PSS)

Gender	Extraction Difficulties [n/(%)]			
	Routine	Moderate	Difficul	Total
Male	6	38	17	61
Female	2	53	28	83
Total	8(5,6)	91(63,19)	45(31,25)	144(100)
Asymp.Sig.		0,143		

Using the PSS index (table 5), it is shown that the majority (63.19%) of impacted lower third molars have a moderate level of extraction difficulty; followed by difficult extraction (31.25%), and only 5.6% have easy or routine extraction difficulty. The Chi-Square test found that there was no relationship between gender and the level of difficulty in extracting impacted lower third molars (p<0.05).

Prediction of the level of difficulty of extraction of impacted lower third molar teeth in this study was assessed using the previously developed impacted tooth extraction difficulty index, namely the Pederson Scoring System (PSS). It is known that the PSS index is formulated based only on radiographic assessments. Although it is difficult to estimate the difficulty of extracting impacted lower third molars using radiological methods alone, PSS has considered 3 main aspects related to the difficulty of extracting impacted lower third molars, namely: tooth angulation, tooth eruption depth and the presence of space related to the mandibular ramus. Many researchers say that these three factors are the main components in determining the level of difficulty in extracting impacted teeth. Although there are several other more reliable indexers (because they involve intra-operative variables), the PSS Index is widely cited in many oral and maxillofacial surgery textbooks to predict the difficulty of extracting impacted lower third molars [10].

As with other impacted tooth extraction difficulty indices, the PSS index is also pre-operative only. Assessment of the difficulty of extracting impacted lower third molars is not only considered very important for formulating an optimal treatment plan, but also for calculating the advantages and disadvantages of the surgical procedure. In addition, preparing predictions of the

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difficulty of extracting impacted teeth is also to be able to plan and manage properly the potential complications during surgery (intra-operative) and post-operatively. Evaluation of the difficulty of impacted third molar surgery is a crucial stage in formulating an optimal treatment plan and in obtaining a balance between the benefits and side effects of the surgical procedure [11].

The results of this study (table 1) found that the frequency of lower third molar impaction occurred more frequently in women than in men. The results of this study are in line with previous research, for example by Barunawaty and Tenrilili in 2023 which was conducted in Makasar City, Indonesia, which found the prevalence of lower third molar impaction in women was 60.1% [12], while other studies found 63% [13] and 65.7% [14]. However, several studies have stated that the incidence of impaction of the lower third molar teeth in women and men is not statistically significant [12][15]. The most commonly cited explanation is that jaw growth patterns differ between the sexes [12]. Jaw growth in women stops earlier than in men and this causes the size of women's jaws to generally be smaller than that of men [13], or the space available for the eruption of the lower third molar teeth in women is often insufficient, so the risk of impaction becomes greater. Meanwhile, a study found a relationship between gender and duration of surgery which showed a difference in the difficulty of extracting impacted teeth between the two sexes. Male subjects generally have larger tooth crown sizes, roots, and thick buccal fat tissue, causing third molar tooth extraction to be more difficult in men than in women [16].

In this study, the research sample was also grouped by age group (table 2), and it was found that the research sample was mostly in the age range of 20-30 years. The incidence of tooth impaction is generally not influenced by increasing age. The high frequency in this age range only reflects the increasing awareness of dental examination and treatment. Age is one of the risk factors for difficulty in surgical treatment of impacted lower third molars [11]; The difficulty of extraction score will increase as the patient's age increases. The positive relationship between age and difficulty in extracting lower third molars is due to bone density, more complete root growth, and the possibility of ankylosis with increasing age [16]. Age is also a factor that affects wound healing; wound healing will be slower with increasing age [17].

The results of this study obtained the predicted value of difficulty in extracting the lower third molar teeth (both in men and women) at most was a moderate level (63.19%), followed by a high level and the least was a easy (routine) level. These results certainly cannot be separated from the prevalence of each variable in the PSS index assessment, namely the angulation of the impacted teeth, the depth of the impacted teeth and the available space for the mandibular ramus

The results of this study are in accordance with other studies (although using different assessment indices). The study by Bhuju et al. (2018) which used the duration of extraction as an indicator of the difficulty of extracting impacted teeth, which was conducted on 401 participants in Kathmandu, Nepal, also obtained a moderate difficulty category [16]. Research by Aya Ali on 54 respondents (20 men and 34 women) at Suez Canal University using the pre-operative difficulty index, also found that the most (48.15%) were at a moderate level of difficulty [13]. Research by Rivera et al (2021) on 77 patients using the PSS index found that 52.85% had moderate levels of difficulty [18]. Meanwhile, research by Janjua et al. (2013) on 50 patients using the PSS index found the same results between easy/routine and moderate levels of difficulty, 40% each [19].

The PSS index uses 3 main variables related to the difficulty of extracting impacted lower third molars: tooth angulation, tooth eruption depth and space availability in relation to the mandibular ramus. These three variables in the PSS index are only determined radiographically. Some researchers or experts say that the PSS index has limitations in predicting the difficulty of lower third molar impaction surgery [9]. A study found that the PSS Index showed low sensitivity and specificity in predicting the difficulty of lower third molar impaction surgery. Their literature review concluded that the PSS index is not a reliable test to predict the difficulty of impacted mandibular third molar surgery [8]. Another report concluded that the Pederson index failed to accurately predict the difficulty of tooth extraction, especially in cases of distoangular impaction [19]. Among the reasons is that the Pederson Index is based only on radiographic assessment and therefore cannot describe the actual difficulty [20]. Thus, according to them, it is difficult to accept that it is possible to estimate the difficulty of extracting impacted lower third molars using only radiographic methods.

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Conclusion

Prediction of the level of difficulty in extracting the lower third molar teeth at RSGMP, Jember University (both in male and female patients) using the Pederson Scoring System is mostly a moderate level of difficulty.

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