



Retrospective Study of The Accuracy of Panoramic Interpretation The Difficulty in Surgical Removal of Impacted Mandibular Third Molar Comparing With Actual Surgical Procedure

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Abstract

The most common surgical procedure performs by an oral surgeon is the surgical removal of impacted mandibular third molars. Evaluating the degree of difficulty of these wisdom teeth surgical removal is extremely important to plan proper treatment for reducing the risk of complications. This study aims to analyze the accuracy of the difficulty index of impacted mandibular third molar through panoramic radiograph by using proposed modified Kharma scale correlate with an actual procedure through a modified Parant scale for prognosticating of the index of difficulty. The difficulty of the surgical removal of 214 lower third molar treated in the College of Dental Medicine, Rangsit University, was predicted by the modified Kharma and modified Parant (MK/MP) scale. Finally, these results were compared with the actual procedure of individual cases in terms of the modified Parant (MP) scale. Only 50% (107 from 214) of teeth (95% CI: 0.4-0.6) are correspondence in number between preoperative MK/MP scale and postoperative MP scale. In addition, Cohen/Conger's Kappa statistics showed the calculated result of 0.2313, which the Benchmark scale as a reference qualified as fair. Statistic results showed little value for the prediction of the surgical removal's difficulty by the proposed MK/MP scale. The revision of the scales must be taken other radiological and clinical information's as well as weighing score into account for further study.

Keyword: Mandibular third molar, Kharma scale, Parant scale, Impacted tooth, Panoramic radiograph, and Surgical removal

1. Introduction

The most common surgical procedure performed by the surgeon is the extraction of impacted mandibular third molars (Latt, Chewprecha, & Wongsirichat, 2015). An assessment of the surgical complexity of third molar extraction is a crucial step to formulate an optimal treatment plan. An accurate evaluation is also essential to plan a proper surgical intervention to minimize and manage intraoperative complications and postoperative pain and swelling (Stacchi et al., 2018).

Panoramic radiography is the most common technique used for preoperative assessment for the impacted third molars (Freire et al., 2019). Traditionally, the conventional radiographic images of impacted mandibular third molar have been commonly categorized based on position in terms of depth and ramus relationship (Pell and Gregory classification system) and inclination (Winter classification system) for evaluation of removal hardship. Various indexes have been proposed as a classification to predict a preoperative difficulty grading of mandibular third molar surgical removals, such as the Kharma and Parant scales (Al-Samman, 2017). After the literature review, the study of Al-Samman in 2017 on the accurate prediction of the difficulty index of the aforementioned procedure by the Kharma and modified Parant scales was unreliable as the preoperative predictor. However, panoramic radiograph is still a basic investigation that is available in daily clinical dental practice. Thus, this study had modified and proposed some factors that were different from an original Kharma scale, which brought us to the research question of this study "Do an interpretation the difficulty index of impacted mandibular third molar through panoramic radiograph by using the proposed modified Kharma scale correlate with an actual procedure through the modified Parant scale?"



2. Objectives

To determine the accuracy of predicting the difficulty index in surgical removal of impacted mandibular third molar by interpretation of panoramic radiograph using the proposed modified Kharma scale and compare the difficulty index of individual cases with an actual clinical procedure by using the modified Parant scale.

3. Materials and Methods

3.1. Study population

The sample of this study were patients in the College of Dental Medicine, Rangsit University, who received a surgical removal of an impacted mandibular third molar with no age restriction.

Inclusion criteria:

- Patients who had surgical removal of a mandibular third molar with good quality of the preoperative panoramic film.
- The duration between a taken preoperative panoramic radiograph and the surgical removal was not more than 3 years.
- Treatment record of the selected patient during 2019-2020 is available
- Have a second mandibular molar adjacent to the operated impacted mandibular third molar to possibly measure an angulation of impacted mandibular third molar

Exclusion criteria:

- Patients who had pathologic lesion around impacted mandibular third molar, which was observed in panoramic radiograph

Sample size calculation

From the review of "Evaluation of Kharma scale as a predictor of lower third molar extraction difficulty" (Al-Samman, 2017), they found that the accuracy of estimating the difficulty of impacted mandibular third tooth removal from radiograph as compared with the actual clinical procedure had a sensitivity of 18.2% and specificity of 68.4%. Using a statistical calculation, therefore, the number of the sampling population must be at least 193 cases.

3.2. Materials and equipment

The panoramic radiograph was obtained by Planmeca®, Helsinki Finland, and processed using Planmeca Romexis® software.

3.3. Method

This study was approved by the University Ethical Board (RSU-ERB2020/085.2506).

Sample collection

The sample was collected by searching at the dental student procedure's log file in the department of oral surgery, College of Dental Medicine, Rangsit University, between 2019 to 2020. Only 214 mandibular impacted teeth followed the inclusion criteria. Cases that followed the exclusion criteria were excluded from the sample.

Tool of measurement

This study modified the original Kharma scale in the part of angulation of impacted lower third molar following the Winter's classification (mesioangular, horizontal, distoangular, vertical) by dividing an angulation into 3 groups (-15° to 15°, 16° to 25°, and 26° to 90°) and adding a root curvature in the root form's criterion for scoring as the difficulty index (Table 1).



In this study, one well-trained rater performed a radiographic measurement and analyzed panoramic radiographs in the “ROMEXIS” software. After each interpretation of the panoramic radiograph, an experienced surgeon supervised and verified the correctness of the measurement. An evaluation of the accuracy of one rater by re-examining the radiograph interpretation 7 days later. Intraclass Correlation Coefficient (ICC) was calculated for confirming the statistical preciseness of rater’s measurement by using Cohen Kappa’s statistical analysis. The ICC’s result was 0.982 according to an interpretation by using the Benchmark scale as a reference guideline. The interpretation showed excellent because 0.982 was in the highest range of the guideline, meaning that the rater had perfect accuracy in measurement.

Table 1 Criteria of the modified Kharmas scale

Criteria of Modified Kharmas scale	
Classification	Score
Angulation	
-15° to 15°; vertical, mild mesioangular, mild distoangular	0
16° to 25° and -16° to -25°; mesioangular, distoangular	1
26° to 100° and -26° to -80°; mesioangular, distoangular, horizontal	2
Depth	
Position A: high occlusal level	1
Position B: medium occlusal level	2
Position C: deep occlusal level	3
Ramus relationship/space available	
Class 1: sufficient space	0
Class 2: reduced space	1
Class 3: no space	2
Roots form	
Convergent	0
Divergent	1
Bulbous, Root curvature	2
Difficulty index	
Easy	1-2
Moderately	3-5
Difficult	6-9

Table 2 Criteria of the modified Parant scale

Criteria of the modified Parant scale	
Easy	Extraction requiring forceps only +/- flap operation
Moderately	Extraction requiring open flap and osteotomy
Difficult	Extraction requiring open flap, osteotomy, and tooth section

For the modified Parant scale, adjustments were made from the Parant scale in which the difficulty index of the procedure was divided into three levels: easy, moderate, and difficult (Table 2).

In this study, the difficulty of preoperative surgical removal of impacted mandibular third molar was evaluated from the panoramic radiograph using the Planmeca Romexis based on the modified Kharmas scale



and compared with the actual procedure from the treatment record by using the criteria of modified Parant scale, which indicated whether the difficulty indexes were corresponding or not.

The data collected in the Microsoft Excel program were converted to STATA afterward. The data were divided into 3 sheets. The first sheet consisted of general information about the patients and data interpreted from panoramic radiographs. The second sheet showed scores according to the criteria of the modified Kharma scale and criteria of the modified Parant scale. The last sheet compared the paired cases between the preoperative difficulty index evaluated from the panoramic radiographs using the modified Kharma scale and the postoperative difficulty index of the actual operative procedure that used the modified Parant scale. If it was corresponding, it would be given a value equal to "1." Otherwise, if it was not corresponding, it would be given a value equal to "0." The data were analyzed using STATA Statistics. A P-value of <0.05 and 95% confident interval were taken to indicate a statistical significance.

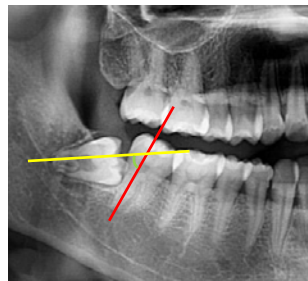


Figure 1 Angulation measurement of the second and third lower molar in Romexis® program

4. Results and Discussion

4.1 Result

Table 3 Classification of 214 surgical removals by the preoperative modified Kharma scale and postoperative modified Parant scale

		Modified Parant scale			Total
		Easy	Moderate	Difficult	
Modified Kharma scale	Easy	7	4	4	15 (7%)
	Moderate	3	57	95	155 (72.4%)
	Difficult	0	1	43	44 (20.6%)
	Total	10 (4.7%)	62 (29%)	142 (66.4%)	214 (100%)

Percent Agreement = 0.5 (95%CI: 0.4-0.6)

Cohen/Conger's Kappa = 0.2313 (95%CI: 0-0.2)

Statistically significant difference ($p < 0.001$)

As shown in Table 3, the result indicated with the circles showed the number of impacted mandibular molar in which the preoperative modified Kharma scale and postoperative modified Parant scale had the same difficult index. They comprised of 7 'Easy' teeth, 57 'Moderate' teeth, and 43 'Difficult' teeth. To summarize, only 50% (95%CI: 0.4-0.6), or 107 from 214 teeth, were concordances in the number of preoperative modified Kharma scale and postoperative modified Parant scale. Furthermore, Cohen/Conger's Kappa statistics of STATA 16 were calculated considering the Benchmark scale as a reference and found that the Cohen/Conger's Kappa was 0.2313 (95%CI: 0-0.2). This value showed a statistically significant difference in accuracy in surgical removal procedures from the patients' records ($p < 0.001$). Thus, using this proposed preoperative modified Kharma scale and postoperative modified Parant scale for forecasting a difficulty index was qualified as fair.



4.2 Discussion

Various indexes have been proposed and were used by the clinicians to classify the difficulty of surgical removal of the mandibular third molar. The Pederson difficulty index is mainly based upon anatomical and radiographic features, including angulations, depth, and ramus relationship. However, the Pederson scale was tested by several studies and was claimed to be an unreliable predictor of true difficulty (Yuasa, Kawai, & Sugiura, 2002). According to Kharma et al. (2014), the Kharma scale was formed, evaluated, and modified from the Pederson scale. In contrast, the proposed Kharma scale showed more accuracy and reliability in the preoperative estimation of the difficulty of the surgical removal of impacted third molars than the Pederson scale.

According to the statistic result, it was indicated that the modified Kharma scale and modified Parant scale in this study had low accuracy for the prediction of the surgical removal difficulties of the impacted mandibular teeth. From the result, the preoperative modified Kharma scale has classified most of the cases as 'moderate' (72.4.%) while the postoperative modified Parant scale has classified most of the cases as 'difficult' (66.4%). In detail, the most uncorrelated results were found in 95 cases out of 214, by which the preoperative modified Kharma scale classified these cases as 'moderate' but the postoperative modified Parant scale classified them as 'difficult.' It implied that the proposed preoperative Kharma scale underestimate the difficulty index comparing with the actual ones, which may exemplify by several reasons. First, due to individual experience, some surgeons prefer to separate wisdom teeth into pieces when confronting with only a curve, bulbous, or divergent roots to avoid unexpected and unfavorable root fracture patterns. Such surgeons' decision causes the more frequent occurrence of tooth section rate, which subsequently increases an uncorrelated number of difficulty index according to the preoperative modified Kharma scale. Secondly, the panoramic radiographic assessment was demonstrated in only 2 dimensions, the anteroposterior aspect, which is insufficient to see the relationship of impacted mandibular third molar to the adjacent second mandibular molar in the buccolingual aspect. If an impacted mandibular third molar has much more tilting of the crown to lingual aspect, it will cause the coronal part of the impacted tooth locked to the bone undercut. This situation increases the chance to reduce bone and separate the tooth during the operation. In addition, the curve root is sometimes an unpredictable factor, as it is often not visible in the panoramic radiographs (Al-Samman, 2017) if it is curved into the buccolingual direction. Therefore, clinical assessment during operation is an additional consideration. Moreover, improper range of score in the preoperative modified Kharma scale may result in inconsistent with the modified Parant scale. For example, it was varied in distoangulation. Some distoangulation cases were given scores of 0 and 1 while some cases of mild degree of distoangulation should have tooth resection because other factors like insufficient space distally, obstructing the removal path. Nevertheless, the part of angulation of the modified Kharma scale that was classified by angle instead of the direction of angulation was more practical to predict the difficulty of a procedure than the previous scale.

Additionally, it should consider another risk factor such as the root proximity of the mandibular third molar to the inferior alveolar nerve, which is related to an apico-coronal position of a wisdom tooth that is determined by the mandibular canal. It was mentioned that the root proximity of the mandibular third molar to the mandibular canal is considered a risk factor for damaging the inferior alveolar nerve during the extraction (Juodzbalsys, & Daugela, 2013). Al-Samman (2017) stated in their study that their proposed Kharma scale was unreliable as a preoperative predictor of the lower third molar extraction difficulty. The study of Kharma is recommended to add the other risk factors in the difficult index score, such as the height of mandible, angulation of the second molar, root number, follicle development, path of exit of the tooth during removal, which should also be taken into account, along with the length of time for removal of the teeth, the flap designs, the root anatomy, and the surgeon's experience (Khanal, Dixit, Singh, & Dixit, 2014). It was why the authors proposed and tested both the modified Kharma scale and modified Parant scale, although the statistical result did not support the accuracy of panoramic interpretation of the difficulty in surgical removal of impacted mandibular third molar teeth. Further studies have to develop a new scale covering more factors about teeth (e.g. angulation between each root and number of roots) and adjacent structures and ranging a proper new score or weighing system. So, the Modified Kharma scale should be



adjusted to cover more factors about teeth and range a new proper score. It is also important to study other factors, whether the patients' age, systemic disease, surgeon's experience, or expertise.

5. Conclusion

The values showed a statistically significant difference between the preoperative modified Kharmas scale and the postoperative modified Parant scale for forecasting the difficulty index ($p < 0.001$). Therefore, the modified Kharmas and modified Parant scale should not be used alone in the prediction of the surgical removal difficulty but may be used as part of the evaluation of the difficulty together with other factors that affect the procedure. It is also important to study other factors, whether the patients' age, systemic disease, or surgeon's expertise, and it would be great to study by using 3D images that make it possible to see the impacted tooth from another aspect.

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