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Research Article

Evaluation of Recently Proposed Scales as Predictors of Mandibular Third Molar Extraction Difficulty

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Abstract

Background: The Prediction of extraction difficulty of impacted mandibular third molar (M3M) is extremely important for both patients and clinicians. Recently, many new difficulty-estimating indices had been proposed, among them are, Zhang et al., Kim et al., Pernambuco, Lainez et al., and Roy et al. indices. This study aimed to evaluate the validity of these new scales as preoperative predictors of the difficulty of surgical removal of impacted M3M.

Material and Methods: The five scales under study predicted extraction difficulty of a series of 50-impacted M3M preoperatively, and postoperative difficulty was assessed with Parant scale (PS) and by the time required for surgery (TS).

Results: The proposed indices had low to moderate sensitivity (21%-45%, 41%-67%) and variable in their specificity (21%-86%, 36%-85%).

Only three out of five evaluated indices have shown a statistically significant correlation with both, the operation time and the surgical technique; namely, Zhang et al., Pernambuco, Lainez et al. indices.

Conclusions: Zhang et al., Pernambuco, Lainez et al. indices can be used as preoperative predictors of the impacted M3M extraction difficulty.

Keywords: Zhang et al. index; Kim et al. index; Pernambuco index; Lainez et al. index; Roy et al. index; Prediction scale; Mandibular third molar; Extraction difficulty.

Introduction

Prediction of the degree of impacted mandibular third molar (M3M) extraction difficulty is essential to plan treatment options, and to limit the risk of complications. Therefore, there is continuous challenge to clinician to have optimal scale that predict M3M extraction difficulty [1]. Researchers in previous studies had evaluated such difficulties [2,3-6].

Classic difficulty scoring models were based on radiographic variables [7-9], while the recent ones had associated additional clinical, non-radiographic variables [10,11]. Pederson scale, among these scales, is widely used as a prediction tool of extraction difficulty of M3M [12]. However, many researchers have questioned its performance [5,12].

Other indices have been proposed for preoperative estimation of difficulty, but they found invalid [4,5,11,12] or of limited clinical use [5,11,13-15]. Due to these drawbacks, there is a continuous need for developing an index that can precisely determine the extraction difficulty of M3M. In the last years, many new difficulty-estimating indices had been proposed; they are Zhang et al. index, Kim et al. index, Pernambuco index, Lainez et al. index, and Roy et al. index [16-20]. Some of them based on radiographical variables only [17,19], while others involve additional clinical and demographic variables [16,18,20]. Authors of these indices claimed that they are valid and reliable prediction tools. The aim of this study was to evaluate the prediction accuracy of these new scales.

Material and methods

Surgical extraction of fifty M3M were evaluated for patients who presented to the private clinic of authors located in Mosul city, Iraq from June to December 2021. All patients signed informed consent and the study approved by the local ethics committee. All operations executed according to standard protocols under local anesthesia by two surgeons (A.A., G.M.) who had eleven and fifteen years of experience in oral surgery. Preoperatively, the authors of this study predicted the difficulty of extraction from panoramic radiographs according to five indices; Zhang et al., Kim et al., Pernambuco, Lainez et al., and Roy et al. index [16-20] (Figure 1-5).

Any disagreement among authors solved by consensus. Two outcome variables were considered to assess extraction difficulty: the surgical technique using Parant scale (PS), and the time required for surgery (TS) (from start of incision to final suture) (Table 1).

Statistical analysis using descriptive statistics of IBM SPSS Statistics 23, sensitivity, specificity and likelihood ratios were calculated considering the PS and ST as a reference. In addition, the correlation between the operative time and the difficulty of operation as proposed by all scales were also assessed by analysis of variance test. A probability value (P) of less than 0.05 was considered significant.

Results

Fifty patients (26 female and 24 male) between 17 and 42 years of age (mean age of 26.9 ± 6.35 years) were analyzed. Right mandibular (n=23) and left (n=27) wisdom teeth were extracted.

Table 2 illustrate the difficulty of fifty extraction as classified by preoperative prediction scales and postoperative PS and TS.

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Criterion	Score
Degree of bone impaction	
None	0
Partial	2
Full	3
Shape of roots	
Normal	0
Swollen root	1
Crooked root	2
Impaction angle	
<30°	0
≥30°	1
Relation to IAC	
None	0
Touching	0.5
Crossing	1
Roots, n	
1	0
≥2	1
Age (yr)	
≤25	0
25-35	1
≥35	2
Difficulty score	
Low	0-5.4
Moderate	5.5-7.4
High	7.5-10

Abbreviation: IAC, inferior alveolar canal.

Figure 1: Zhang et al. index.

1- Spatial relationship
- Mesioangulated (1)
- Horizontal (2)
- Vertical (3)
- Distoangulated (4)
- Reverse (5)

2- Depth level
- Level A (1)
- Level B (2)
- Level C (3)
- Level D (4)

3- Ramus relationship
- Class I (1)
- Class II (2)
- Class III (3)

Scoring:

3-4: Slightly difficult

5-7: Moderately difficult

8-10: Very difficult

11-12: Extremely difficult

Figure 2: Kim et al. index.

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Variable	Classification	Value
Level of the occlusal plane (Pell and Gregory)	A	1
	B	2
	C	3
Available retromolar space (Pell and Gregory)	1	1
	2	2
	3	3
Impaction angle (Winter)	Vertical	1
	Mesioangular	2
	Horizontal	3
	Distoangular	4
Root curvature	Non-dilacerated	1
	Dilacerated	2
Number of roots	One fused root	1
	≥2 roots	2
	Tooth germ	3
Relationship to the second molar	No contact	1
	Contact with crown alone	2
	Contact with root	3
Age (years)	<25	1
	≥25	2
BMI (kg/m^2)	18.5–24.9 (ideal weight range)	1
	≥25 (overweight)	2

Surgical difficulty	Index score
Low	8–12
Moderate	13–17
High	18–22

BMI, body mass index.

Figure 3: Pernambuco index.

1. Inclination of third molar: • Vertical (1) • Mesial (2) • Distal or horizontal (3)	6. Winter's distance: • < 5 mm (1) • 5–9 mm (2) • > 9 mm (3)
2. Inclination of second molar: • Mesial (1) • Vertical (2) • Distal (3)	7. Coronal width: • < 10.0 mm (1) • 10.0–11.5 mm (2) • > 11.5 mm (3)
3. Pericoronal radiolucency: • Large (1) • Small (2) • Not visible (3)	8. Distance from mandibular ramus to distal surface of the second molar: • 10.5–14 mm (1) • 8.0–10.5 mm (2) • 2.0–8.0 mm (3)
4. Root radiolucency: • Large (1) • Small (2) • Not visible (3)	9. Coronal area: • 20–75 mm2 (1) • 75–90 mm2 (2) • 90–130 mm2 (3)
5. Root shape: • Single or fused (1) • Separate (2) • Dysmorphic or anomalous (3)	10. Root length: • 3.0–8.0 mm (1) • 8.0–9.5 mm (2) • 9.5–13.0 mm (3)
Scoring: 10-16: Mild 17-23: Moderate 24-30: High	

Figure 4: Lainez et al. index.

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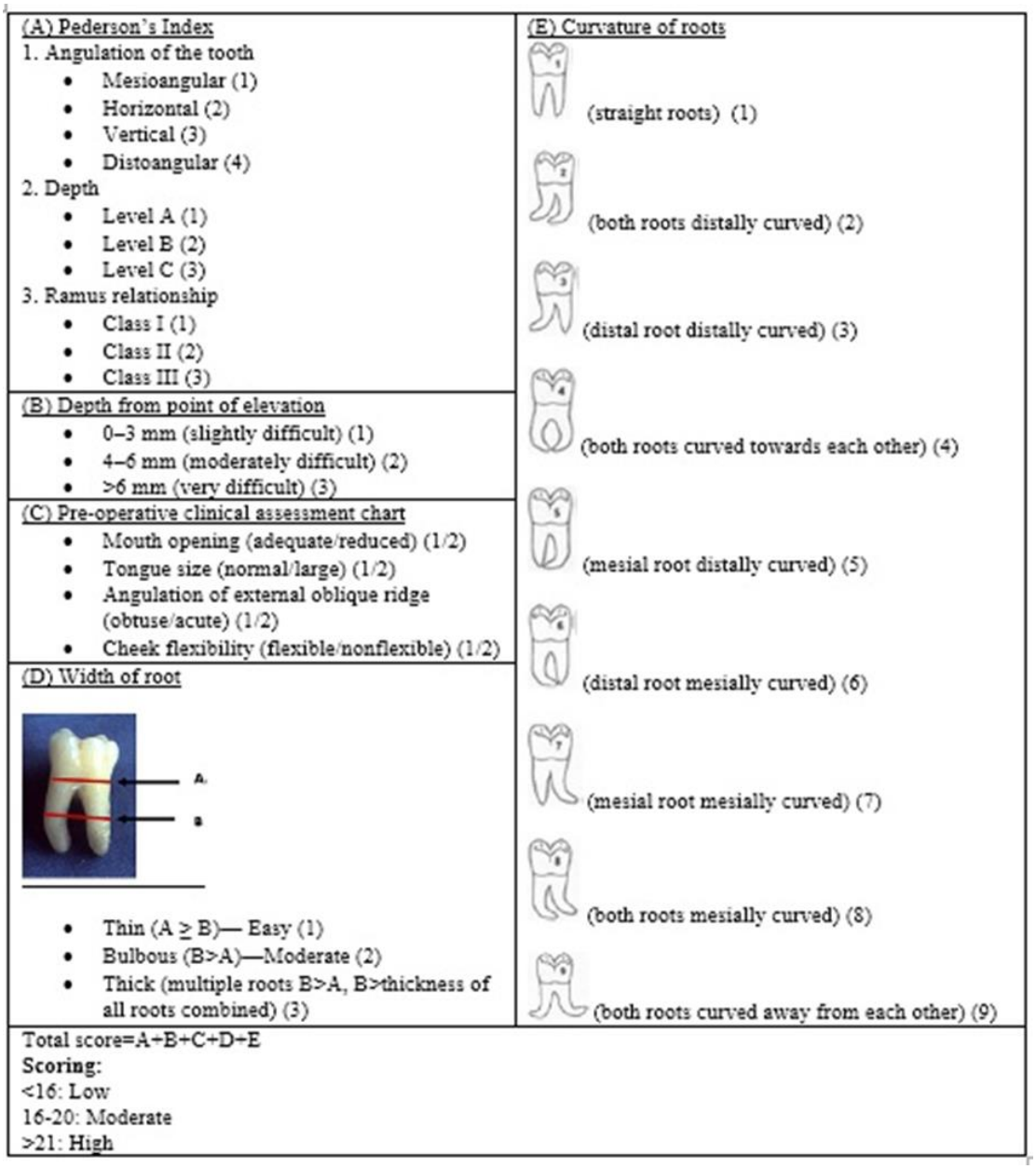

Figure 5: Roy et al. index.

Criteria of Parant Scale	
Classification of difficulty	Actions required for extraction
Low	Extraction requiring forceps/elevator alone
Moderate	Extraction requiring osteotomy
High	Extraction requiring osteotomy and tooth section
Criteria of Surgical Time	
Classification of difficulty	Time elapsed between incision and final suturing
Low	<15 min
Moderate	15-30 min
High	>30 min

Table 1: Classification of extraction difficulty: Parant scale (surgical technique) and surgical time.

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According to PS, extraction was easy in 19 (38%) patients. In contrast, extraction was of moderate difficulty with osteotomy performed in 16 (32%) patients whereas additional tooth sectioning (difficult extraction) was carried out in 15 (30%) patients. The minimum time of surgery was 1 min while the maximum TS was 40 min with a mean duration of 14.8 ± 10.28 min.

Accordingly, difficulty of extraction was considered low in 32 (64%) cases, moderate and high in 13 (26%), and 5 (10%) cases respectively (Table 2).

	Parant scale			**Surgical time**			
	Low	Moderate	High	Low	Moderate	High	Total
Roy et al. index							
Low	11	4	9	17	4	3	24
Moderate	6	12	4	13	8	1	22
High	2	-	2	2	1	1	4
Total	19	16	15	32	13	5	50
Lainez et al. index							
Mild	12	5	2	18	2	-	20
Moderate	7	11	13	14	11	5	30
High	-	-	-	-	-	-	-
Total	19	16	15	32	13	5	50
Pernambuco index							
Low	10	4	2	15	1	-	16
Moderate	9	12	13	17	12	5	34
High	-	-	-	-	-	-	-
Total	19	16	15	32	13	5	50
Zhang et al. index							
Low	18	10	9	28	7	2	37
Moderate	1	4	4	3	5	1	9
High	-	2	2	1	1	2	4
Total	19	16	15	32	13	5	50
Kim et al. index							
Slightly difficult	5	5	5	12	2	1	15
Moderately difficult	13	8	10	17	10	4	31
Very difficult	1	3	-	3	1	-	4
Extremely difficult	-	-	-	-	-	-	-
Total	19	16	15	32	13	5	50

Table 2: Classification of extraction difficulty according to new indices, Parant scale and surgical time.

Roy et al. index: The minimum score of difficulty is 10 points, with a maximum of 33 points. Extraction was of low difficulty (≤ 16 points) in 24 (48%) of patients, moderate difficulty (17-20 points) in 22 (44%) patients and high difficulty (>21 points) in 4 (8%) patients (Table 2). Depending on PS and ST as outcome assessors, this index showed limited predictive sensitivity (45.2%, 52.9%) and specificity (57.9%, 51.5%), The likelihood ratios of prediction were not significant as they ranged between 0.5 and 2 (Table 3 and 4).

No significant correlation (P=0.915, 0.16) exist between both; the PS and TS with extraction difficulties as predicted by Roy index (Table 5).

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Index	Sensitivity	Specificity	Positive Likelihood ratio	Negative Likelihood ratio
Roy et al. index	45.20%	57.90%	1.074	0.946
Lainez et al. index	35.50%	63.20%	0.965	1.021
Pernambuco index	37.30%	58.80%	0.905	1.066
Zhang et al. index	20.70%	85.70%	1.448	0.93
Kim et al. index	23.80%	21.10%	0.502	3.61

Table 3: Sensitivity, Specificity and likelihood ratios of indices for prediction of Parant's categories.

Index	Sensitivity	Specificity	Positive Likelihood ratio	Negative Likelihood ratio
Roy et al. index	52.90%	51.50%	1.09	0.915
Lainez et al. index	61.10%	56.30%	1.4	0.69
Pernambuco index	66.70%	46.90%	1.26	0.71
Zhang et al. index	41.20%	84.80%	2.71	0.69
Kim et al. index	58.80%	36.40%	0.92	1.13

Table 4: Sensitivity, Specificity and likelihood ratios of indices for prediction of surgical time categories.

Index	Parant scale		Surgical time		
	Person Correlation (r)	P	Surgical time min (SD)	Person correlation (r)	P
Roy et al. index					
Low	0.015	0.915	13.33 (11.31)	0.202	0.16
Moderate			15.05 (8.26)		
High			22.25 (13.35)		
Lainez et al. index					
Mild	0.418**	0.003	8.35 (4.97)	0.517**	0
Moderate			19.1 (10.71)		
High			-		
Pernambuco index					
Low	0.351	0.012	7.25 (6.05)	0.509**	0
Moderate			18.35 (9.99)		
High			-		
Zhang et al. index					
Low	0.329*	0.02	12.41 (9.13)	0.442**	0.001
Moderate			19 (9.66)		
High			27.5 (11.85)		
Kim et al. index					
Slightly difficult	-0.08	0.583	11.53 (9.93)	0.173	0.229
Moderately difficult			16.32 (10.71)		
Very difficult			15.25 (6.55)		
Extremely difficult			-		

Table 5: Correlation of indices with surgical time and Parant scale.

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Lainez et al. index: The score of difficulty is ranged from 10 to 30 points. Extraction was of mild difficulty (10-16 points) in 20 (40%) of patients, and moderate difficulty (17-23 points) in 30 (60%) patients. No case recorded as high difficult (Table 2). This index revealed low to intermediate sensitivity (61.1%, 35.5%) and specificity (56.3%, 63.2%). The likelihood ratios of prediction were not significant. (Table 3 and 4). Among other indices, this index showed highest correlation (r=0.418, 0.517) with PS and TS respectively (Table 5).

Pernambuco index: According to this index, surgery was of mild difficulty in 16 (32%) patients when scored between 8 to 12 points. Moderate in 34 (68%) extraction with 13-17 points. High difficult extraction (18-22 points) was not encountered (Table 2). Considering PS as outcome variable, this index showed low sensitivity (37.3%) and intermediate specificity (58.8%) (Table 3). Comparing to other indices, Pernambuco index is the most sensitive one (66.7%) with a significant correlation with TS (P=0.001) but with limited specificity (46.9%) (Table 4). The likelihood ratios were not significant (Table 3 and 4). A significant correlation (P=0.12, 0.000) exist between index prediction with both; the PS and TS (Table 5).

Zhang et al. index: The minimum score of difficulty is 0 points, while the maximum is 10 points. Surgeries of 0-5.4 points were categorized as low difficult (74% of cases). Moderate (5.5-7.4 points) and high (7.5-10) difficulty in 9 (18%) and 4 (8%) patients respectively (Table 2). There is a low to limited sensitivity (20.7%, 41.2%) and highest specificity (85.7%, 84.8%) among scales. One of the positive likelihood ratios was significant (2.71), while the negative likelihood ratios were not (0.93, 0.69) (Table 3 and 4). A significant correlation (P=0.020, 0.001) existed between PS and TS with difficulties predicted by Zhang index (Table 5).

Kim et al. index: This index consists of four categories. Extraction was considered slightly difficult (3-4 points) in 15 (30%) patients and moderately difficult (5-7 points) in 31 (62%) patients. Four cases (8%) recorded as very difficult (8-10 points) and there is not extremely difficult (11-12 points) extraction (Table 2). This index gave low to accepted sensitivity (23.8%, 58.8%) and lowest specificity (21.1%, 36.4%) in contrast to other scales. Regarding the likelihood ratios, only the negative likelihood ratios for prediction of Parant categories was significant (3.61) while the other ratios were not (Table 3 and 4). No significant correlation (P=0.538, 0.229) exist between the index difficulties with PS and TS (Table 5).

Discussion

The classic Pell and Gregory, and Winter classifications of impacted M3M based on their relative occlusal depth, the relation to the mandibular ramus and the tooth angulation in respect to the long axis of the adjacent second molar. Over decades, many modifications of these scales have been proposed to improve the prediction of extraction difficulty [19].

Many radiographical and clinical parameters should be considered before surgery for correct evaluation and prediction of M3M extraction difficulty. They help in drawing of correct treatment plan to improves patient's outcomes [12,21].

Different scales were proposed as predictors of M3M extraction difficulty; however, some of these scales have drawbacks. Bali et al.

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[22] in their meta-analysis study concluded that Pederson scale is not valid index in M3M. MRACBS scale [15] need to cone beam computed tomography in classification of wisdom teeth, giving a limited practical implication. WHARFE index [23] and Sammartino Index [24] is rarely used in practice owing to its complexity [12]. Koerner index [9] is similar to Pederson index in that it measures the same radiographical parameters. However, these indices have not been validated [18].

Yuasa index [5] and Kharma scale [14] consider not only the relative depth and relation with the mandibular ramus as Pederson index, but also the root width and form. Gbotolorun et al. [11] proposed an index depends on four variables: two clinical and two radiographic. It is differed from Pederson index in that it does not consider neither the tooth relation to mandibular ramus nor the tooth angulation.

In the present study, we consider PS and ST to determine extraction difficulty like many previous studies [Zhang et al., Pernambuco, Roy et al.], they considered as a standard protocol to accurately assess surgical difficulty [16,18,20]. The proposed indices had low to moderate sensitivity (21%-45%, 41%-67%) and variable in their specificity (21%-86%, 36%-85%), and may be related to some limitations.

For instance, In Roy index, pericoronal or periradicular radiolucency, the number roots, root proximity to adjacent second molar or inferior dental canal (IDC) were not considered during difficulty assessment. In addition to absence of important clinical variables such as body mass index (BMI) and age that could influence the level of difficulty in M3M surgery as reported by other researchers [11].

Both, Kim et al. [17] and Lainez et al. [19] index depended only on radiographical parameters and did not consider any clinical factor like BMI, tongue size, cheek flexibility, and mouth opening. These factors also not addressed in Pernambuco index along with pericoronal or periradicular radiolucency or root relation to IDC.

Again, these factors also not considered in Zhang et al. index [16] in addition to lack of detailed description of relative tooth angulation, depth and relation to mandibular ramus.

Three of the five difficulty indices evaluated in the present study have shown a statistically significant correlation with the operation time and the surgical technique; namely, Zhang et al., Pernambuco, Lainez et al. indices [16,18,19]. Although came from different populations, studies that reported these three indices were almost similar to our study in regard to patient's average age, surgical technique, and patterns of the impacted teeth. This coincidence may explain the high predictability of these indices for the level of surgical difficulty assessed in the present study. A common radiographic factor that was considered in calculating each of the three indices was the number and morphology of roots of the impacted M3M. The difficulty of extraction of these teeth is directly proportional to the number and complexity of their roots. Adding this factor to Pederson's scale would expectedly increase its reliability in assessing the surgical difficulty of these procedures. The coronal width of M3M is another local anatomic parameter which was measured by Lainez et al. study and might have improved the predictability of their scale [19]. The wider the crown of the tooth, the longer time would be required to

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perform bone removal and tooth division, resulting in a longer operation time. This simple parameter can be readily evaluated on the preoperative conventional radiograph.

Evidence has shown that both clinical and demographic factors should be considered in assessing the difficulty of impacted M3M surgery [11]. Of these factors, patient's age was considered in both Pernambuco and Zhang indices. It is obvious that surgical difficulty is increased in older patients due to changes in the dental and tooth investing tissues. Incomplete root formation, more elastic bone, and pericoronal follicle space seen in patients younger than 25 years of age are usually associated with less difficult surgery.

Two indices, Kim's et al. [17] and Roy's et al. [20] scales, correlated weakly with the time of operation and Parant's scale in the present study. In both of these proposed indices, patient's age and number of roots of impacted M3M were neglected in the final scoring. Kim et al. focused only on local radiographic parameters and depended on a modified Pederson scale with 4 instead of 3 categories of difficulty. Unlike our study, the most common pattern of impaction treated by these authors was the horizontal rather than mesioangular impaction, indicating the involvement of more difficult cases in their study [17]. The authors to their working in a tertiary medical institution linked this finding and that relatively simple cases were presumably referred to be treated in private clinics elsewhere.

In their index, Roy et al. also did not take into account demographic features of the patients. Roy's index consisted of many parameters and a maximum score of 33 with 3- step difficulty scale [20]. Such a detailed index with exhaustive graduation may not be straightforward for many surgeons to calculate. In addition, gathering of all potential factors in one index without calibration of the significance of each factor might have decreased rather than increased the sensitivity of the created index. The authors did not report the patterns of impaction in their study, and they performed bone removal and tooth division in all cases, which makes Roy's index more suitably applicable for difficult than for easy procedures. According to our best knowledge, the validity of above indices as prediction tools were not tested before except for Pernambuco index which proven to be a reliable index with high sensitivity (87.9%), specificity (93.1%). However, these results were not corresponded to ours.

References

1. Al-Samman AA. Evaluation of Kharma Scale as a Predictor of Lower Third Molar Extraction Difficulty. Med Oral Patol Oral Cir Bucal. 2017;22(6):e796-e799. PubMed | CrossRef
2. Renton T, Smeeton N, McGurk M. Factors Predictive of Difficulty of Mandibular Third Molar Surgery. Br Dent J. 2001;190(11):607-10. PubMed | CrossRef
3. Santamaria J, Arteagoitia I. Radiologic Variables of Clinical Significance in the Extraction of Impacted Mandibular Third Molars. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1997;84(5):469-73. PubMed | CrossRef
4. García AG, Sampedro FG, Rey JG, Vila PG, Martin MS. Pell-Gregory Classification is Unreliable as a Predictor of Difficulty in Extracting Impacted Lower Third Molars. Br J Oral Maxillofac Surg. 2000;38(6):585-587. PubMed | CrossRef
5. Yuasa H, Kawai T, Sugiura M. Classification of Surgical Difficulty in Extracting Impacted Third Molars. Br J Oral Maxillofac Surg. 2002;40(1):26-31. PubMed | CrossRef

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DOI: https://doi.org/10.37191/Mapsci-2582-3736-4(3)-134

6. Cortell-Ballester I, Almendros-Marqués N, Berini-Aytés L, Gay-Escoda C. Validation of a Computer-Assisted System on Classifying Lower Third Molars. Med Oral Patol Oral Cir Bucal. 2011;16(1):e68-73. PubMed | CrossRef
7. Winter GB. Principles of Exodontia as Applied to the Impacted Third Molar. American Medical books, St Louis. 1926.
8. Pell GJ. Impacted Mandibular Third Molars: Classification and Modified Techniques for Removal. Dent Digest. 1933;39:330-8.
9. Koerner KR. The Removal of Impacted Third Molars. Principles and Procedures. Dent Clin North Am. 1994;38(2):255-78. PubMed
10. Susarla SM, Dodson TB. Risk Factors for Third Molar Extraction Difficulty. J Oral Maxillofac Surg. 2004;62(11):1363-71. PubMed | CrossRef
11. Gbotolorun OM, Arotiba GT, Ladeinde AL. Assessment of Factors Associated with Surgical Difficulty in Impacted Mandibular Third Molar Extraction. J Oral Maxillofac Surg. 2007;65(10):1977-83. PubMed | CrossRef
12. Diniz-Freitas M, Lago-Méndez L, Gude-Sampedro F, Somoza-Martin JM, Gándara-Rey JM, García-García A. Pederson Scale Fails to Predict How Difficult it will be to Extract Lower Third Molars. Br J Oral Maxillofac Surg. 2007;45(1):23-6. PubMed | CrossRef
13. Santosh P. Impacted Mandibular Third Molars: Review of Literature and a Proposal of a Combined Clinical and Radiological Classification. Ann Med Health Sci Res. 2015;5(4):229-34. PubMed | CrossRef
14. Kharma MY, Sakka S, Aws G, Tarakji B, Nassani MZ. Reliability of Pederson Scale in Surgical Extraction of Impacted Lower Third Molars: Proposal of New Scale. J Oral Dis. 2014. CrossRef
15. Juodzbalys G, Daugela P. Mandibular Third Molar Impaction: Review of Literature and a Proposal of a Classification. J Oral Maxillofac Res. 2013;4(2):e1. PubMed | CrossRef
16. Zhang X, Wang L, Gao Z, Li J, Shan Z. Development of a New Index to Assess the Difficulty Level of Surgical Removal of Impacted Mandibular Third Molars in an Asian Population. J Oral Maxillofac Surg. 2019;77(7):1358.e1-1358.e8. PubMed | CrossRef
17. Kim JY, Yong HS, Park KH, Huh JK. Modified Difficult Index Adding Extremely Difficult for Fully Impacted Mandibular Third Molar Extraction. J Korean Assoc Oral Maxillofac Surg. 2019;45(6):309-315. PubMed | CrossRef
18. de Carvalho RWF, Vasconcelos BC. Pernambuco Index: Predictability of the Complexity of Surgery for Impacted Lower Third Molars. Int J Oral Maxillofac Surg. 2018;47(2):234-240. PubMed | CrossRef
19. Ribes Lainez N, Sanchis Gonza´lez JC, Pen˜arrocha Oltra D, Sanchis Bielsa JM. Importance of a Preoperative Radiographic Scale for Evaluating Surgical Difficulty of Impacted Mandibular Third Molar Extraction. J Oral Science Rehabilitation. 2017:3:52–9.
20. Roy I, Baliga SD, Louis A, Rao S. Importance of Clinical and Radiological Parameters in Assessment of Surgical Difficulty in Removal of Impacted Mandibular 3rd Molars: A New Index. J Maxillofac Oral Surg. 2015;14(3):745-9. PubMed | CrossRef
21. Barreiro-Torres J, Diniz-Freitas M, Lago-Méndez L, Gude-Sampedro F, Gándara-Rey JM, García-García A. Evaluation of the Surgical Difficulty in Lower Third Molar Extraction. Med Oral Patol Oral Cir Bucal. 2010;15(6):e869-74. PubMed | CrossRef
22. Bali A, Bali D, Sharma A, Verma G. Is Pederson Index a True Predictive Difficulty Index for Impacted Mandibular Third Molar Surgery? A Meta-analysis. J Maxillofac Oral Surg. 2013;12(3):359-64. PubMed | CrossRef
23. MacGregor AJ. The radiological assessment of ectopic lower third molars. Ann R Coll Surg Engl. 1979;61(2):107-13. PubMed
24. Sammartino G, Gasparro R, Marenzi G, Trosino O, Mariniello M, Riccitiello F. Extraction of Mandibular Third Molars: Proposal of a New Scale of Difficulty. Br J Oral Maxillofac Surg. 2017;55(9):952-957. PubMed | CrossRef

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