

# Modified Difficulty Index Adding Extremely Difficult for Mandibular Third Molar Extraction

Numrah Shakeel Malik, Ayesha Maqsood, Sidra Ayaz, Minahil Fatima

## ABSTRACT

**Objective:** To evaluate the frequency and distribution of difficulty levels in impacted mandibular third molar extractions using the Modified Difficulty Index (MDI), and to assess intra-observer agreement with the index components.

**Study Design and Setting:** A cross-sectional study carried out in the Oral & Maxillofacial Surgery department of Foundation University College of Dentistry & Hospital for a six months duration.

**Methodology:** Consecutive patients (n = 225) with fully impacted mandibular third molars, aged 18–60 years, were enrolled. Panoramic radiographs were scored by a single researcher using the MDI (spatial relationship, depth, ramus/space). MDI scores totalled (3–12) were grouped as slightly, moderately difficult, very difficult, and extremely difficult. Data were analysed with SPSS v27; categorical data as frequencies (%), continuous as mean  $\pm$  SD; quadratic weighted kappa measured agreement;  $p = 0.05$  is significant.

**Results:** The mean age was  $29.31 \pm 8.64$  yrs; 86 (38.2%) males and 139 (61.8%) females. Kappa values showed substantial agreement for spatial relationship (0.775), depth (0.744), and ramus relationship (0.663); overall total-score agreement was 0.855. Distribution: Category I 14 (6.2%), II 164 (72.9%), III 34 (15.1%), IV 13 (5.8%). Horizontal impaction (39.1%) and Level B depth (46.7%) were most common. Older age correlated with higher difficulty ( $P < 0.001$ ).

**Conclusion:** The Modified Difficulty Index (MDI) demonstrates high intraobserver agreement for radiographic scoring of fully impacted mandibular third molars and describes the distribution of radiographic difficulty categories in this single-center sample. A small subset of cases were classified as extremely difficult radiographically.

**Keywords:** Impacted, Molar, Third, Radiography, Panoramic, Mandible, Surgical Difficulty Index,

## How to cite this Article:

Malik NS, Maqsood A, Ayaz S, Fatima M. Modified Difficulty Index Adding Extremely Difficult for Mandibular Third Molar Extraction. J Bahria Uni Med Dental Coll. 2026;16(4):908-14 DOI: <https://doi.org/10.51985/JBUMDC20261035>

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## INTRODUCTION

The extraction of mandibular third molar is one of the most regularly executed oral surgery globally. Nevertheless, these extractions are highly complex, with a wide range of complexities, from simple to very difficult, based on a

combination of anatomical, radiographic, and clinical factors.<sup>1,2</sup> Surgical difficulty assessment is essential in preoperative planning, patient counseling, and risk assessment because it allows clinicians to predict the scope of surgery, potential complications, and the best surgical approach.<sup>3,4</sup> Winter's and Pell and Gregory's classifications are some of the classification systems established to quantify the difficulty of 3rd molar extractions. These systems classify impactions based on spatial relationships, depth, and available space to provide a general assessment of the extraction difficulty. However, they are not precise when applied to fully impacted cases, as they do not consider all the variables that affect surgical complexity.<sup>5,6</sup> Traditional difficulty indices may not accurately predict the actual time needed for extraction, the necessity for alternative surgical procedures, and the risk of complications, including dead nerves, excessive bleeding, and postoperative infection. To offset these drawbacks, the Modified Difficulty Index (MDI) was designed to supplement the evaluation of the difficulty of extraction of mandibular third molars. In addition to adding parameters such as depth, angulation, and position of the impacted tooth relative to defined anatomical structures, the parameters included are more clinically relevant.<sup>7,8</sup> Compared to the conventional classification

### Numrah Shakeel Malik

Postgraduate Resident, Department of Dentistry  
Foundation University College of Dentistry & Hospital,  
Foundation University Islamabad  
Email: numrahshakeelmalik@outlook.com

### Ayesha Maqsood

Consultant, Department of Dentistry  
Foundation University College of Dentistry & Hospital,  
Foundation University Islamabad  
Email: Ayeshamaqsood.fucd@fui.edu.pk

### Sidra Ayaz

Postgraduate Resident, Department of Dentistry  
Foundation University College of Dentistry & Hospital,  
Foundation University Islamabad  
Email: sidraayaz03@gmail.com

### Minahil Fatima

Demonstrator, Department of Dentistry  
Foundation University College of Dentistry & Hospital,  
Foundation University Islamabad  
Email: minahil.fatima@fui.edu.pk

Received: 28-05-2026  
Accepted: 22-09-2026

1st Revision: 08-06-2026  
2nd Revision: 19-06-2026  
3rd Revision: 09-09-2026

system, the MDI is different in that the difficulty grade it provides is not broad or oversimplified, and it indicates a graded difficulty assessment from slightly difficult to extremely difficult.

Kim et al. performed a panoramic radiographic study on 154 patients with 204 impacted mandibular third molars. According to their findings, out of a total of 205 impacted mandibular third molar cases that were evaluated, the majority—149 cases, representing 73.0% of the sample—were categorized as Category II (moderately difficult). This indicates that most extractions fell within the mid-range of surgical complexity, requiring careful planning but generally manageable with standard oral surgical techniques. In addition, 28 cases (13.7%) were classified as Category III (very difficult), reflecting a subset of patients in whom anatomical positioning or depth of impaction posed greater challenges and demanded advanced surgical skill. A smaller proportion of cases were distributed at the extremes of the difficulty spectrum: 13 cases (6.4%) were placed in Category IV (extremely difficult), highlighting those rare but clinically significant scenarios where extraction was particularly complex, often due to deep impaction or unfavorable angulation. Conversely, 14 cases (6.9%) were categorized as Category I (slightly difficult), representing the least challenging extractions in the cohort. This distribution underscores the predominance of moderately difficult cases while also emphasizing the importance of recognizing and preparing for the smaller, yet critical, subset of extremely difficult extractions that carry higher risk and require specialized surgical expertise.<sup>7</sup> Similarly, Ku et al. applied the One-Up Difficult Index using Kim et al.'s criteria to analyze the difficulty levels among patients. According to their findings, 13 cases (16.46%) were classified as Category I and 34 cases (43.04%) were classified as Category II. Furthermore, 16 cases (20.25%) were classified as Category III, and five cases (6.33%) were classified as Category IV, which is the most complex extraction.<sup>8</sup> Based on these findings, we highlight the importance of improving the classification system for accurate prediction of surgical difficulty.

The rationale of the present study was to measure the difficulty in surgeries of fully impacted mandibular third molar extractions using the Modified Difficulty Index, which is a more refined classification system than conventional difficulty indices. This is particularly significant since there has not yet been any research done locally with this newly defined criterion. The index will therefore be employed in our clinic in order to provide us with an even more objective measurement of extractability. This will provide some means of predicting case complexity more accurately and provide preoperative patient counseling, as well as optimizing procedural planning and minimizing intraoperative complications.

## METHODOLOGY:

This study was designed as a cross-sectional investigation conducted at Oral and Maxillofacial Surgery Department in the Foundation University College of Dentistry and Hospital, Foundation University Islamabad, over a period of six months following the approval of the synopsis under letter number: CPSP/REU/DSG-2023-136-4861, Dated: July 19, 2025. A sample size of 225 was obtained based on 95% confidence level, absolute precision of 3.2%, and an expected proportion of 6.4% difficult cases among completely impacted mandibular third molars using the Modified Difficulty Index through the use of the WHO sample size calculator. Non-probability sampling with consecutive technique was applied in this study. Inclusion criteria comprised patients undergoing the extractions of the fully impacted mandibular third molars, cases where more than 2/3rd of the crown was impacted in alveolar bone, individuals aged 18 to 60 years, and both genders.

Exclusion criteria included third molars associated with pathological conditions, patients with systemic conditions contraindicating surgery, and those with a history of prior surgical attempts involving the same tooth. Ethical approval for this study was first sought from the hospital's Ethics Committee and College of Physicians & Surgeons of Pakistan, followed by acquiring consent from all subjects. Demographic data, along with information related to the clinical condition, such as name, age, and gender, was gathered. The site of impaction was categorised as right mandibular, left mandibular, or bilateral. The difficulty index for all cases was assessed using the Modified Difficulty Index after panoramic X-ray imaging, following a standardised procedure. All Panoramic Xrays were taken by My Ray 2D Pan & Ceph Model: Hyperion X5 (Italy) and the software used for analysis was iRay Company Software by a single observer to avoid any inter-observer or inter-software/machine bias. Third molars were scored according to the modified index. To assess intraobserver repeatability, a random sample of 50 radiographs (22% of the dataset) was selected using a random number generator and rescored by the same observer after an interval of four weeks. The observer was blinded to the first set of scores during rescoring. Quadratic weighted kappa was used to quantify intraobserver agreement for each MDI component (spatial relationship, depth, ramus/space) and for the total MDI score. Kappa values were interpreted using Landis and Koch criteria.

Categorical variables are presented as frequencies and percentages; continuous variables as mean  $\pm$  SD. Post-stratification chi-square tests were used to examine associations between MDI categories and categorical radiographic variables. Because the total MDI score is derived from the three component scores, associations between components and total score are expected by construction; therefore, component-level associations are

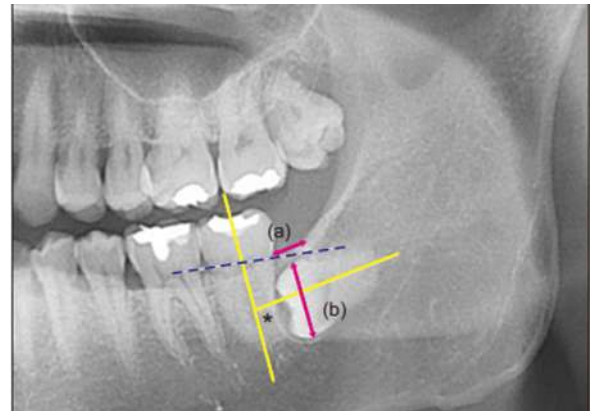
presented descriptively and interpreted as associations rather than independent predictive evidence. All hypothesis tests were two-sided and a  $p = 0.05$  was considered statistically significant. Analyses were performed in SPSS v27

The spatial relationship of impacted mandibular third molars was systematically classified according to the angulation of the tooth relative to the adjacent second molar and the occlusal plane. A mesioangular impaction was identified when the long axis of the third molar was inclined forward, forming an angle between  $11^\circ$  and  $79^\circ$ , thereby tilting toward the distal surface of the second molar. In contrast, a distoangular impaction was characterized by an angulation ranging from  $-11^\circ$  to  $-79^\circ$ , in which the crown was directed posteriorly, away from the second molar, often complicating surgical access. A horizontal impaction was defined when the tooth was oriented nearly parallel to the occlusal plane, with angulation values between  $80^\circ$  and  $100^\circ$ , representing a situation where the crown lies directly against the root of the adjacent tooth. A vertical impaction was recorded when the tooth exhibited a relatively upright orientation, with angulation values falling between  $-10^\circ$  and  $10^\circ$ , suggesting that the third molar was aligned in a manner similar to normal eruption but remained unerupted due to lack of space. Additionally, a distinct category termed reverse impaction was noted in cases where the crown was oriented in a root-directed position rather than horizontally aligned, representing an atypical and rare pattern of impaction. This classification system provided a structured framework for analyzing the spatial orientation of impacted third molars, ensuring consistency in reporting and facilitating meaningful comparisons across difficulty categories. Impaction level was determined by how deeply the third molar was compared to its position in relation to the CEJ of the second molar tooth. Impaction level A referred to instances where more than  $\frac{1}{2}$  of the crown lay above Cemento Enamel Junction. Impaction level B referred to situations where less than  $\frac{1}{2}$  of the crown lies above the Cemento Enamel Junction. In instances where the crown is entirely below the Cemento Enamel Junction, it could either be at level C or level D. Level C referred to situations where more than  $\frac{1}{2}$  of the impacted third molar tooth crown was above the root mid-level of the adjacent molar tooth.

The availability of eruption space was assessed for determining the possibility of the eruption of third molar. The classification would depend on the ratio between the available space (a), which is found between the ascending ramus and the distal aspect of the second molar, and the size of the impacted third molar (b). If the eruption space ratio  $a/b$  is greater than two-thirds, it will be categorized as Class 1, indicating sufficient space for eruption. Class 2 would be used where the ration is between one-third and two-thirds, indicating moderate availability of space. Class 3 would be selected where the ratio is less than one-third, indicating insufficient space for eruption.

All evaluations were conducted by the single researcher to ensure consistency, avoiding inter observer bias.. The data was collected using a predefined form for systematic documentation. Radiographs that were unclassifiable for a given component (poor image quality, overlapping structures, or ambiguous anatomy) were recorded as “Not recorded/ambiguous” and excluded from component-level frequency denominators but retained in the overall sample ( $N = 225$ ). Modified Difficulty Index: A grading system for assessing the difficulty of fully impacted mandibular third molar extraction. It considers the spatial relationship, depth, and available space, with a total score ranging from 3 to 12, to classify the difficulty levels. (Annexure-II) Difficulty index has been described on the basis of the total score as: Slightly difficult ( score: 3-4 ), Moderately difficult (scores: 5-7), Very difficult (scores: 8-10 ), Extremely difficult (scores: 11-12). Scoring according to difficulty in spatial relationship is done as: Mesioangular (1), Horizontal (2), Vertical (3),

Figure 1: Classification of impaction of the third molar.



The spatial relation was classified according to the angle formed by the longitudinal axis of the impacted third molar to the adjacent second molar (yellow line and the yellow asterisk). The depth classification was determined by the line drawn from the CEJ of the adjacent second molar (dotted blue line). The space available for the ramus was sub-classified based on the ratio of distance (a) from the ascending ramus of the mandible to the distal aspect of the second molar and the diameter of the impacted tooth (b)

B. The Depth Score is Level A = 1, Level B = 2, Level C = 3 and, Level D = 4

Figure 2 A. Level A, if more than half of the crown of impacted third molar existed above the cervico-enamel junction (CEJ) of the adjacent second molar.

B. Level B, if less than half of the presented crown is above the CEJ. Level C (C) and Level D (D) if the entire crown of the impacted third molar is below CEJ of the adjacent second molar. Level C was described by the authors as a state where more than half of the impacted third molar crown exists above the middle level of the adjacent second molar root. Third molar crowns below the aforementioned point

Figure 2: Depth.



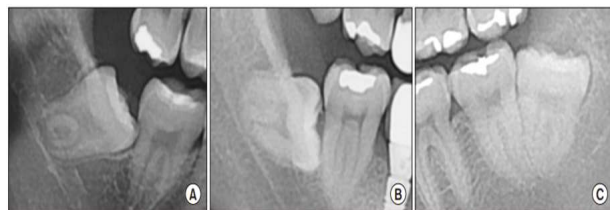
were considered Level D.

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Ratio of space to ramus is scored as follows:

Class 1 = 1, Class 2 = 2 and, Class 3 = 3

Figure 3: Relationship/Space available Ramus



A. Class I. B. Class II. C. Class III. The eruption space was measured by taking the ratio between the distance from the ascending ramus to distal side of the second molar (a) and the diameter of the impacted wisdom tooth (b). This was shown in fig. When the eruption space ratio was greater than  $\frac{2}{3}$ rd, then the condition was classed as Class I, when between  $\frac{1}{3}$ rd to  $\frac{2}{3}$ rd, it was Class II, and when less than  $\frac{1}{3}$ rd, it was Class III. All the information was recorded and analyzed using spss version 27.0. Quantitative variables like age, and scores of difficulty indices are shown in mean  $\pm$  standard deviation while categorical variables include gender, impacted tooth site, smoking status, comorbidities, and difficulty indices level were shown in percentages. The data were stratified according to age & gender, to control for confounders, and a post-stratification chi-square test was applied to assess the difficulty level within subgroups. The level of significance was set at  $\alpha=0.05$ .

## RESULTS

Total of 225 patients were included in the study, with 225 fully impacted mandibular third molars assessed using the Modified Difficulty Index (MDI). The mean age of the participants was  $29.31 \pm 8.64$  years (ranging from 18 to 60 years). The number of male subjects among these was 86 (38.2%), and that of females was 139 (61.8%). No significant

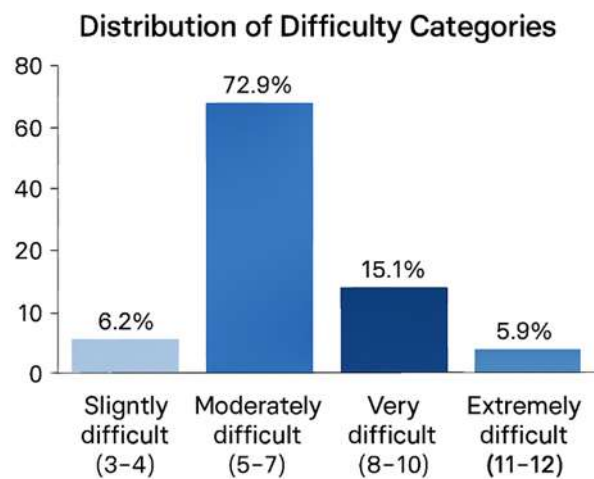
difference was found in the mean age of males ( $30.18 \pm 8.97$  years) and females ( $29.70 \pm$ ).

Quadratic weighted kappa values quantify intraobserver agreement for the radiographic scoring. Substantial agreement was observed for the spatial relationship (kappa = 0.775, 95% CI 0.684–0.866), depth (kappa = 0.744, 95% CI 0.673–0.815), and ramus/space relationship (kappa = 0.663, 95% CI 0.573–0.753). The overall agreement for the total MDI score was high (kappa = 0.855). The quadratic weighted kappa values reported in this manuscript quantify intraobserver agreement (same observer rescoring the same radiographs). Agreement between Pederson's index and the MDI was not performed in this study and therefore is not reported. Out of 225 cases, 14 (6.2%) were classified as Category I (slightly difficult, 3–4 points), 164 (72.9%) as Category II (moderately difficult, 5–7 points), 34 (15.1%) as Category III (very difficult, 8–10 points), and 13 (5.8%) as Category IV (11–12 points, extremely difficult). The majority of cases were moderately difficult, while extremely difficult cases represented the smallest proportion.

In total, twenty-one radiographs within the dataset presented at least one evaluative component that could not be reliably classified. This lack of classification was primarily attributable to factors such as ambiguous anatomical landmarks, indistinct structural orientation, or compromised image quality that rendered accurate interpretation difficult. For these particular cases, the affected components were formally documented as “Not recorded/ambiguous” in order to maintain transparency and methodological rigor. As a direct consequence of these exclusions, the denominators used for calculating component-level frequencies differ from the overall sample size reported in the study. This distinction is important because it explains why, in certain categories, the summed frequencies do not equal the full cohort of 225 patients but instead total 204, reflecting the subtraction of the 21 unclassifiable entries. The adjustment ensures that statistical analyses are based only on interpretable data, thereby preserving validity while acknowledging unavoidable limitations inherent in radiographic assessment. This methodological note has been highlighted in the footnotes of Table 1 to guide readers in correctly interpreting the reported distributions and to prevent misinterpretation of apparent discrepancies between component totals and the overall sample size.

Horizontal impaction was the commonest spatial relationship observed, accounting of 39.1% cases, followed by mesioangular impaction (35.6%). Reverse impaction was the least frequent pattern, occurring in only 6.7% of cases, but it was strongly associated with Category IV difficulty. In terms of depth, Level B was the most prevalent at 46.7%, followed by Level C at 26.2%. Level D was rare, observed in just 4.0% of cases, yet it was consistently classified as extremely difficult. Level D impactions were uncommon ( $n = 9$ ) and were distributed across Category III ( $n = 3$ ) and

Figure 4: Distribution of difficulty categories



Category IV (n = 6); Level D impactions were more frequently observed in the higher difficulty categories but were not exclusively classified as Category IV. Regarding the ramus relationship, Class II was the most frequent at 47.6%, while Class III, present in 44.0% of cases, was strongly associated with higher difficulty categories.

The mean age of patients demonstrated a clear and progressive increase across the different categories of surgical difficulty

as defined by the Modified Difficulty Index (MDI). Specifically, individuals classified within Category I exhibited a relatively younger mean age of  $25.64 \pm 6.30$  years, reflecting cases that were generally less complex and more straightforward to manage. In contrast, patients falling into Category II showed a modest rise in mean age to  $28.23 \pm 7.95$  years, suggesting that moderately difficult extractions were more frequently encountered in slightly older individuals. This upward trend continued in Category III, where the mean age reached  $31.82 \pm 9.57$  years, indicating that very difficult impactions were increasingly associated with patients in their early thirties. The most striking difference was observed in Category IV, where the mean age escalated to  $40.15 \pm 7.93$  years, highlighting that extremely difficult cases were predominantly concentrated among older patients. Statistical analysis confirmed that this age-related gradient was highly significant ( $P < 0.001$ ), thereby reinforcing the conclusion that advancing age is strongly correlated with higher MDI categories. These findings underscore the clinical relevance of patient age as a predictive factor in assessing extraction complexity, emphasizing that older individuals are more likely to present with deeply impacted or anatomically challenging third molars requiring advanced surgical expertise.

In summary, this single-center radiographic sample of 225

Table 1. Age, gender, and pattern of impaction according to difficulty index

| Variable            | Category I<br>(n=14, 6.2%) | Category II<br>(n=164, 72.9%) | Category III<br>(n=34, 15.1%) | Category IV<br>(n=13, 5.8%) | Total<br>(N=225) | P-value |
|---------------------|----------------------------|-------------------------------|-------------------------------|-----------------------------|------------------|---------|
| Age (years)         | $25.64 \pm 6.30^*$         | $28.23 \pm 7.95^*$            | $31.82 \pm 9.57$              | $40.15 \pm 7.93$            | $29.31 \pm 8.64$ | <0.001  |
| Gender              |                            |                               |                               |                             |                  |         |
| Male                | 2                          | 65                            | 12                            | 7                           | 86               | 0.149   |
| Female              | 12                         | 99                            | 22                            | 6                           | 139              |         |
| Spatial relation    |                            |                               |                               |                             |                  |         |
| Mesioangular        | 14                         | 66                            | 0                             | 0                           | 80               | <0.001  |
| Horizontal          | 0                          | 72                            | 0                             | 0                           | 88               |         |
| Vertical            | 0                          | 8                             | 0                             | 0                           | 8                |         |
| Distoangular        | 0                          | 10                            | 0                             | 3                           | 13               |         |
| Reverse             | 0                          | 0                             | 2                             | 13                          | 15               |         |
| Not recorded/ambig. | 0                          | 0                             | 15                            | 6                           | 21               |         |
| Depth               |                            |                               |                               |                             |                  |         |
| Level A             | 9                          | 22                            | 0                             | 0                           | 31               | <0.001  |
| Level B             | 5                          | 92                            | 8                             | 0                           | 105              |         |
| Level C             | 0                          | 35                            | 17                            | 7                           | 59               |         |
| Level D             | 0                          | 0                             | 3                             | 6                           | 9                |         |
| Ramus relation      |                            |                               |                               |                             |                  |         |
| Class I             | 7                          | 12                            | 0                             | 0                           | 19               | <0.001  |
| Class II            | 7                          | 93                            | 7                             | 0                           | 107              |         |
| Class III           | 0                          | 59                            | 27                            | 13                          | 99               |         |

\* $P < 0.05$  compared to Category IV.

**Note:** 21 radiographs were unclassifiable for component-level scoring (recorded as "Not recorded/ambiguous"); component frequencies therefore sum to 204 for spatial relation and depth where applicable. All 225 cases were included in the total MDI category analysis.

21 radiographs had at least one unclassifiable component; component-level denominators vary accordingly hence not included.

fully impacted mandibular third molars, the MDI demonstrated high intra observer repeatability and described a distribution in which most cases were radiographically classified as moderately difficult; a small proportion were radiographically classified as extremely difficult. Component-level associations with MDI categories were observed, noting that component denominators differ where radiographs were unclassifiable for a given component (see Table 1 footnote)

## DISCUSSION

It is imperative to note the type of impaction and level of difficulty prior to the extraction. Since there are numerous reports showing their association with adverse post-operative outcomes and future management plans. Recent reviews confirm this association: Dignam et al. (2024) highlighted prevalence and the risk factors for complications following tooth extraction, while Yotsova et al. (2025) emphasized the importance of managing sequelae after impacted wisdom tooth surgery.<sup>9,10</sup> The Modified Difficulty Index (MDI) demonstrated strong intraobserver agreement and identified a distinct subset of extremely difficult cases that warrant special preoperative planning. This finding has direct clinical implications because accurate preoperative stratification can guide decisions about referral to specialist care, choice of anaesthesia, and allocation of operative time. Recent work using multidomain clinical–radiographic scales and AI-assisted panoramic analysis supports the value of combining radiographic metrics with clinical variables to improve prediction of operative time and complication risk, reinforcing the practical utility of indices such as the MDI.<sup>11</sup> Radiographic angulation remains a critical predictor of surgical risk. Although Class II was the most frequent, Class III was nearly as common and consistently associated with higher difficulty categories, underscoring its clinical importance. There is one other study that showed the use of AI-assisted panoramic radiography for the prediction of extraction difficulty and injury risks as well as deep learning algorithm to classify the surgical difficulty of the impacted third molar surgery with accuracy in 2025.<sup>11</sup> Pederson's difficulty index has been applied for several research purposes as a predictor of tooth extraction difficulty. Yet, the classification groups are not always consistently and accurately applicable. In a recent study conducted by Jeyashree & Kumar (2022), the index was assessed in modern practice, and there were some limitations noted.<sup>13</sup> Another validation study was conducted by Karamatullah et al., using the index among Pakistani patients,<sup>14</sup> while Önder et al. designed a multidomain classification that better correlated with operation time.<sup>15</sup> The Pell and Gregory classification has also been criticized for its reliability. Simons et al. (2024) showed that Pell & Gregory and Winter classifications influenced coronectomy decisions but were not consistently predictive of surgical difficulty.<sup>16</sup> Patel et al. (2024) reported prevalence and classification patterns in a Gujarat population, while Anggraini & Okviannas (2025) confirmed similar findings

in Indonesia, reinforcing the need for updated classification systems.<sup>17,18</sup>

The strong association between increasing age and higher difficulty categories in our cohort aligns with multicenter analyses showing age-related changes in bone density and root morphology that complicate extraction in older patients. These anatomical changes, together with deeper impactions (Level D) and unfavourable ramus relationships (Class III), explain why older patients more frequently fall into Category IV. Incorporating age as an explicit modifier when counselling patients and scheduling cases may reduce intraoperative surprises and postoperative morbidity.<sup>19</sup> In this research, the mean age was maximum in IV category, while minimum in the I category. It is estimated that the severely impacted third molar has comparatively fewer chances to cause pain or any other problem, such as pericoronitis, therefore, the patient delays his/her hospital visit for an impacted third molar. Recent evidence supports this: Dudde et al. (2024) investigated whether age is a true risk factor for complications in third molar surgery, concluding that older patients face higher surgical difficulty.<sup>19</sup> Consistent with prior studies, sex did not significantly influence difficulty level, suggesting anatomical and radiographic factors are more predictive. The 2025 StatPearls update also emphasized age-related anatomical changes that increase extraction complexity.<sup>20</sup> Thus, taking into account the extraction of teeth among the patients belonging to group IV and the age of the patient, it would become increasingly difficult. Future research needs to focus on the extraction time of these teeth in order to evaluate the predictive ability of this newly devised classification system. Although the MDI performed well in this single-center radiographic study, external validation against actual operative time, intraoperative complications, and multiobserver scoring is needed. Future prospective studies should record extraction duration, need for tooth sectioning or coronectomy, and postoperative outcomes to quantify the index's predictive accuracy. Integration with automated radiographic analysis or deep learning models may further standardise scoring and reduce observer variability, as recent deep learning and AI-assisted studies have shown promising accuracy for difficulty classification and nerve-injury risk prediction.<sup>11</sup>

**Limitation:** This radiographic study describes the distribution of MDI categories and demonstrates intraobserver repeatability on OPG. Prospective validation against operative outcomes (extraction time, need for sectioning/coronectomy, intraoperative complications, postoperative morbidity) clinical difficulty is required to establish predictive validity which is a limitation of study. Variables such as preoperative pain, trismus, smoking status, diabetes, BMI, glycemic control, and mouth opening were not assessed in this study; future prospective studies should include these clinical variables to evaluate whether they improve prediction of operative time and complications.”

**Conflict of Interest:** None

**Fundings:** No funding source

**Use of Artificial Intelligence (AI) Disclosure:** There is no AI tool used.

**Authors Contribution:**

**Numrah Shakeel Malik:** Principal investigator, study conception and design, data collection, statistical analysis, manuscript drafting and corresponding.

**Ayesha Maqsood:** Supervision, critical review of study design, manuscript editing, approval of final draft

**Sidra Ayaz:** Assisted in data collection, literature review, contributed to manuscript writing.

**Minahil Fatima:** Assisted in data collection, literature review, contributed to manuscript writing

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