

# Difficulty of Impacted Mandibular Third Molar Tooth Removal: Predictive Ability of Senior Surgeons and Residents

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**Purpose:** The present study investigated whether residents are able to estimate the degree of difficulty of mandibular third molar removal to the same extent as senior surgeons.

**Materials and Methods:** The study included 2 residents and 2 senior surgeons, each of whom extracted 50 mandibular third molars of similar complexity. The clinical variables evaluated included patient age, gender, body size, maximal mouth opening, and tongue interference. The radiographic variables related to the third molars examined on the panoramic radiographs included spatial positioning, tooth–bone interface, root morphology, and proximity of the tooth to the inferior alveolar canal. Before each extraction, the operating surgeon estimated the level of difficulty of the surgery after considering all the variables. The predicted length of time per operation was regarded as representative of operative difficulty. At the end of each operation, its actual duration was also recorded.

**Results:** The residents and senior surgeons both accurately predicted the difficulty of surgery in just more than one half of the cases. A 57% agreement ( $\kappa = 0.24$ ) was found between the senior surgeons' preoperative estimations and actual difficulty, and the agreement was 52% ( $\kappa = 0.19$ ) for the residents' estimations. No significant difference was found between the senior surgeons and residents in the accuracy of their estimations of operation length.

**Conclusions:** The preoperative prediction of the surgical difficulty of mandibular third molar tooth removal was unreliable, not only for the residents, but also for the senior surgeons.

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*J Oral Maxillofac Surg* 72:1062.e1-1062.e6, 2014

Third molar removal is one of the most frequently performed operations in oral and maxillofacial surgery (OMS). Although it is commonly a straightforward and low morbidity procedure, complications can arise. The difficulty of the surgical removal of third molars will vary from routine to complex. An association between increased surgical difficulty and prolonged recovery after third molar removal has been reported.<sup>1-3</sup> Complications can also be expected to be more commonly encountered as the surgical difficulty increases.<sup>4,5</sup> Gathering accurate information

on the variables related to the difficulty of third molar extraction is important when designing an appropriate procedure and when implementing precautions intended to minimize the risk of complications. Preoperative patient evaluation will allow the surgeon to inform the patients of the possibility of complications associated with surgery and what outcomes to expect during the postoperative period.

Numerous parameters have been investigated that have a potential bearing on the prediction of complexity and difficulty of third molar tooth surgery.

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Received October 1 2013

Accepted January 21 2014

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0278-2391/14/00149-9\$36.00/0

<http://dx.doi.org/10.1016/j.joms.2014.01.023>

Age, gender, angulation, impaction on the horizontal and vertical planes, morphology of the roots, follicle size, periodontal ligament width, and the relationship of the roots to the inferior alveolar canal have all been reported to be associated with operative difficulty.<sup>6-13</sup> All these factors can influence the amount of bone to be removed, the need for root and/or crown sectioning, and accessibility to the surgical site. For instance, bone becomes less elastic in older individuals owing to a reduction of its organic component. Consequently, the bone surrounding the tooth will impede enlargement of the exit route, requiring the removal of more bone during extraction of the impacted tooth. The amount of bone covering the impacted tooth also dictates the amount of bone to be removed during extraction. Moreover, the inclination of an impacted tooth will govern its exit route. Root morphology is important in dictating the mode of surgical technique (eg, root sectioning) to minimize the risk of root fracture. Surgical access can also be hindered by a number of other factors, including limited mouth opening and interference by the tongue.

In OMS departments, residents will initially be assigned less difficult procedures and then gradually perform more complex cases under senior supervision. This helps to reduce the risk of intraoperative and postoperative complications. Jerjes et al<sup>14</sup> reported a greater rate of postoperative complications after third molar surgery in the group treated by junior surgeons compared with the rate for the group treated by their senior counterparts. Therefore, the preoperative evaluation of the parameters related to the complexity of an operation and the determination of its degree of difficulty should facilitate a decision regarding whether the operation should be undertaken by a junior or senior surgeon.

Residents and senior surgeons might interpret the degree of difficulty of the given surgical parameters differently because the relative lack of experience of residents could be expected to limit their ability to predict the surgical difficulty. However, assessing the difficulty of third molar removal in conjunction with its associated factors will usually be quicker compared with most other types of procedures in OMS. Only a few studies have been published that have weighed the estimating ability of trainees against that of surgeons in relation to the difficulty of third molar removal.<sup>15,16</sup> Macluskey et al<sup>15</sup> reported no direct relationship between the predictive ability for surgical difficulty and level of experience of dental hospital staff. In contrast, Ferrús-Torres et al<sup>16</sup> showed that human error in the estimation of the degree of difficulty of third molar tooth removal decreases as surgical experience increases. Therefore, the aim of the present study was to compare the predictive ability of the

experienced oral-maxillofacial surgeons to that of the residents regarding the difficulty of third molar removal.

## Materials and Methods

### RECRUITMENT OF PATIENTS AND CLINICIANS

The participants in the present multicenter study included 1 senior surgeon and 1 resident from each of the 2 oral-maxillofacial surgery clinics of the dental schools of Ondokuz Mayıs and Suleyman Demirel Universities in Turkey. The senior surgeons, both of whom were women and 43 years old, had similar experience in terms of years of practice (approximately 10 years). The 2 residents (1 woman, 26 years old, and 1 man, 25 years old) were in their second year of OMS training. Each unit included 100 consecutive patients scheduled for surgical removal of a mandibular third molar. Therefore, a total of 200 patients were included in the present study. The senior surgeons undertook the extractions of the third molar in one half of the patients, and the residents removed the teeth in the other half. The allocation of patients was conducted by assigning 1 patient from the daily appointment list, consecutively alternating between the senior and junior surgeons. The exclusion criteria were the presence of any major systemic disease and the absence of a second molar adjacent to the extraction site. The institutional clinical studies ethics committee of Suleyman Demirel University approved the study, and all participants provided informed consent.

### PREOPERATIVE RECORDS

Before the surgical removal of third molars, evaluations were made of the clinical and radiographic factors that can be associated with surgical difficulty. Assessments were made of the clinical factors, which included patient age, gender, and weight and access to the surgical site (ie, maximum mouth opening and tongue interference). In addition, radiographic examination of the orthopantomographs was performed. The depth of impaction in both vertical and horizontal planes (determined according to the Pell and Gregory classification) and tooth angulation (determined according to the Winter classification) were used as variables related to spatial positioning of the tooth. Although the tooth-bone interface was examined for periodontal membrane space and follicle space, the root morphology in terms of the root form, root number, and formation was assessed. The proximity of the impacted tooth to the inferior alveolar canal was determined according to the Rood classification (1990).

Before surgery, the level of difficulty of each extraction was intuitively estimated by the operating surgeon after a consideration of the sum of the clinical

and radiographic factors. The estimated operation time was regarded as representative of the degree of difficulty of the operation. The estimated difficulty of the operation was arbitrarily classified as easy, moderately difficult, or difficult for operations expected to take 10 minutes or less, 10 to 20 minutes, or 20 minutes or more, respectively.

#### OPERATIVE RECORDS

All extractions were performed with the patient under local anesthesia. All 4 operating surgeons followed the standard operative technique of using a buccal approach. Depending on the surgical indication, the mucoperiosteal flap was reflected, and osteotomy, coronal sectioning, or root sectioning was performed under constant irrigation with sterile physiologic saline. After closure of the wound with 3-0 silk suture, a piece of folded gauze was applied to the wound for hemostasis. A nonsteroidal anti-inflammatory analgesic was prescribed to each patient. The patients who had undergone osteotomy also received a course of antibiotics as a prophylactic measure. Postoperative oral management was provided to all the patients.

The objective measurement of surgical difficulty was determined by the duration of the operation. The duration of each operation was measured by a third person using a digital chronometer from the beginning of the incision to the placement of the last suture. The surgical difficulty was then graded according to the length of the operation as defined. Procedure completion was also recorded on a 4-class scale, with I, II, III, and IV representing extraction by incision of the soft tissues, extraction by bone removal, extraction by bone removal and coronal sectioning, and extraction by bone removal and crown and root sectioning, respectively. In addition, the operating surgeon specified the reasons whenever the operation took longer, or was more difficult, than expected.

#### STATISTICAL ANALYSIS

All statistical analyses were conducted using the Statistical Package for Social Sciences, version 11.0 (SPSS, Chicago, IL). The complexity of the operations performed by the senior surgeons and residents were compared using the Student *t* test and Mann-Whitney *U* test. The  $\chi^2$  test was used to determine the correlation between the steps taken to complete the operation and the operation duration. The accuracy of the preoperative estimations was delineated; miscalculation of the degree of surgical difficulty (over- or underestimation) was determined as the discrepancy between the preoperative estimate and the actual operative difficulty.  $\kappa$  Values were used to determine the level of agreement between the estimated difficulty and actual difficulty. A  $\kappa$  value of less than 0.40

was taken to indicate poor agreement; 0.40 to 0.59, fair agreement; 0.60 to 0.74, good agreement; and 0.75 to 1.00, excellent agreement. The senior surgeons' and residents' ability to predict operative difficulty was compared using the  $\chi^2$  test.

## Results

The mean operation length corresponding to the surgical complexity of the operation is listed in Table 1. The mean operation duration was  $12.5 \pm 10.5$  minutes (range 2 to 62). The complexity of the operations performed by the senior surgeons and residents was comparable. A similar period was spent on each level of operative complexity by the senior surgeons and residents, and no statistically significant differences were found (Table 1).

A positive correlation was found between the facets of the operation and the operation duration ( $P < .001$ ). Extractions undertaken with forceps or elevator after soft tissue incision required a significantly shorter period than operations that involved sectioning of hard tissue ( $P = .001$ , at least).

Cross-tabulations of the agreement between the operators' preoperative subjective judgments and the actual operation difficulty are listed in Table 2. When the operations were grouped according to duration as easy, moderate, and difficult, the senior surgeons and residents performed similar numbers of operations with regard to the degree of difficulty. The senior surgeons performed 53 cases classified as easy, 32 as moderate, and 15 as difficult compared with 55, 29, and 16 cases classified as easy, moderate, and difficult, respectively, performed by the residents. In total, 75 of 108 (69%) easy, 29 of 61 (48%) moderately difficult, and 5 of 31 (16%) difficult operations were correctly estimated. It appears that as the difficulty of the operation increased, the ability to correctly estimate the difficulty became more problematic. A 57% agreement ( $\kappa = 0.24$ ) was found between the senior surgeons' preoperative estimation and the actual difficulty of the operation. The agreement for the residents' estimation was 52% ( $\kappa = 0.19$ ). When the accuracy of the estimation by senior surgeons and residents was compared, no significant difference was found.

The level of difficulty was correctly estimated in just more than one half of the cases (Table 3). Senior surgeons estimated 57 cases accurately compared with 52 cases by residents. When incorrect estimations were analyzed, the residents appeared to more commonly overestimate the operation difficulty (25 cases) compared with senior surgeons (15 cases). In contrast, although the senior surgeons underestimated the difficulty of 28 cases, 5 fewer cases ( $n = 23$ ) were underestimated by the residents.

**Table 1. FREQUENCY OF CASES AND MEAN OPERATIVE DURATION STRATIFIED BY SURGICAL TECHNIQUE COMPLEXITY**

| Variable                          | Senior Surgeon |                | Resident |                | Total |                |
|-----------------------------------|----------------|----------------|----------|----------------|-------|----------------|
|                                   | n              | Duration (min) | n        | Duration (min) | n     | Duration (min) |
| Incision to the soft tissues      | 40             | 6.5 ± 4.2      | 39       | 6.1 ± 5.0      | 79    | 6.25 ± 5.1     |
| Osteotomy                         | 22             | 12.0 ± 5.3     | 25       | 9.8 ± 5.0      | 47    | 10.8 ± 5.2     |
| Coronal section                   | 17             | 13.2 ± 4.7     | 16       | 15.0 ± 6.1     | 33    | 14.1 ± 5.4     |
| Osteotomy, crown and root section | 21             | 25.6 ± 10.5    | 20       | 26.3 ± 15.6    | 41    | 26.0 ± 13.0    |
| Total                             | 100            | 12.5 ± 9.7     | 100      | 12.4 ± 11.3    | 200   | 12.5 ± 10.5    |

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When the operation took longer than expected, the most common reason cited by the operator was tooth-related factors (26 times), followed by factors unrelated to the difficulty of the extraction per se, but instead to behavioral issues with the individual patients, such as failure to maintain the mouth open sufficiently wide (12 times). Instances of tongue interference (7 times), a repeat of anesthesia (3 times), and intraoperative bleeding control (3 times) were also recorded. In addition, we noted that in 30 cases, radiography had failed to accurately show the root number or curvature.

## Discussion

The results of the present study have shown that the preoperative assessment of surgical difficulty was unreliable even among the senior surgeons. The difficulty of nearly one half of the cases was not correctly estimated during the preoperative evaluation. It has been stated that the surgical difficulty can only be appreciated with certainty during the procedure.<sup>17</sup> This might chiefly result from the shortcomings associated with panoramic tomography, the reliability of which in the estimation of surgical difficulty has recently been questioned. For instance, the Pell and Gregory scales, in terms of both vertical and horizontal

planes, have been reported to be of limited value in predicting the operative difficulty.<sup>18,19</sup> Another problem encountered in reading panoramic radiographs could be that the curvature of the roots is not always detectable. In our study, radiography was unreliable in accurately delineating the root morphology because, in 30 cases, the curvature of root was not discernible on the radiographs. Bell et al<sup>20</sup> also reported that the root numbers and forms were not accurately delineated using panoramic radiography. Moreover, factors not related to the difficulty of the extraction per se, but instead to behavioral issues with individual patients might not be foreseeable before surgery. In our study, failure to maintain the mouth open wide enough during the procedure and tongue interference with surgical access were contributing factors to the prolongation of operations. Therefore, although patient cooperation should be taken into account when attempting to define the degree of surgical difficulty, various radiographic factors should be treated with caution, because they could hamper decision-making.

In our study, the complexity of third molar tooth removal undertaken by all 4 participating surgeons was homogeneously distributed. In total, 79 cases of extraction were by incision of the soft tissues (mean duration 6.25 minutes) and 41 required sectioning of

**Table 2. CROSS-TABULATION COMPARING PREOPERATIVE ESTIMATIONS WITH ACTUAL DIFFICULTY OF OPERATION**

| Actual Difficulty | Preoperative Estimation |          |           |          |          |           |       |          |           |
|-------------------|-------------------------|----------|-----------|----------|----------|-----------|-------|----------|-----------|
|                   | Senior Surgeon          |          |           | Resident |          |           | Total |          |           |
|                   | Easy                    | Moderate | Difficult | Easy     | Moderate | Difficult | Easy  | Moderate | Difficult |
| Easy              | 41                      | 12       | 0         | 34       | 18       | 3         | 75    | 30       | 3         |
| Moderate          | 14                      | 15       | 3         | 11       | 14       | 4         | 25    | 29       | 7         |
| Difficult         | 4                       | 10       | 1         | 5        | 7        | 4         | 9     | 17       | 5         |

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**Table 3. COMPARISON OF PREOPERATIVE ESTIMATIONS IN RELATION TO SURGICAL DIFFICULTY**

| Preoperative Estimation of Difficulty vs Actual Surgical Difficulty | Senior      |              | Total (n) |
|---|-------------|--------------|-----------|
|   | Surgeon (n) | Resident (n) |           |
| Correct   | 57          | 52           | 109       |
| Underestimation   | 28          | 23           | 51        |
| Overestimation  | 15          | 25           | 40        |

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the bone, crown, and root of the tooth (mean duration 26 minutes). No significant differences were observed in the mean operative duration undertaken by senior surgeons and residents. One would expect operations undertaken by senior surgeons to require a shorter period than those undertaken by their junior counterparts. However, third molar removal can generally be regarded as an uncomplicated surgery, for which 2 years of residency appear sufficient to achieve the necessary dexterity. Susarla and Dodson<sup>21</sup> reported that surgical experience was 1 of the factors associated with the operation length, with a negative correlation found between surgical experience and extraction time. However, a wider spectrum of participants was included in their study with regard to the experience level (ie, students, interns, residents, and senior surgeons).

In the present study, the question of whether surgical experience has an effect on the accurate estimation of the difficulty of third molar extraction was investigated. The results showed that junior and senior surgeons demonstrated a similar ability to estimate the difficulty of third molar removal. Likewise, Macluskey et al<sup>15</sup> reported no direct relationship between the predictive ability of surgical difficulty (with regard to what steps would be required to remove the tooth) and level of experience of the dental hospital staff. From our study, it appears that 2 years of training in third molar removal will be sufficient to reach a level of expertise similar to that of experienced surgeons. This could have been because junior residents, who have an opportunity to perform an abundant number of impacted third molar operations under the Turkish Public Health System, gain practical experience rapidly. In contrast, Ferrús-Torres et al<sup>16</sup> stated that first year residents were the participants with the lowest percentage of concordance (69%) in the precision estimation of the correct technique for extraction and that experienced oral-maxillofacial surgeons showed the greatest concordance (80%). In addition, the second year residents had a slightly greater predictive ability (76%) than did the third year residents (74%).

Macluskey et al<sup>15</sup> compared the predictive ability for surgical difficulty of the dental hospital staff with that of dental surgeons in specialist practice. The dental surgeons were accurate in the assessment of the difficulty of surgery 96% of the time, with 66% of the cases correctly estimated by the dental hospital staff. The results were attributed to the fact that the cases undertaken by the dental surgeons had been less complex than those referred to the dental hospital staff. In support of that assertion, we found that, regardless of who performed the estimation, the reliability was less in the prediction of the more difficult cases. Thus, although 70% of the easy cases were correctly estimated, only 16% of difficult cases were.

Overall, our precision in the prediction of difficulty was lower than that in other reports. In a study conducted by Renton et al,<sup>12</sup> in only 10% of patients was a discrepancy found between the preoperative anticipation and postoperative experience of difficulty. For 3% of the patients in their study, the surgery was easier than anticipated and in 7%, it was more difficult than expected. In our study, the operation length was regarded as a measure of extraction difficulty, assuming that more complex operations would require more time to complete. As expected, the operation complexity correlated positively with the operation duration. However, the operative time does not always reflect the extent of surgery. When operations took longer than expected, nearly one half of the reasons cited by the surgeons were factors that cannot be foreseen preoperatively, such as the patient's inability to maintain an adequate mouth opening throughout the operation. That all our extractions were performed with the patients under local anesthesia might have influenced our results. Nevertheless, because our study included only 4 participants (2 residents and 2 surgeons), it could be difficult to generalize the results to most oral-maxillofacial surgeons and residents.

In conclusion, the preoperative prediction of surgical difficulty of mandibular third molar removal was unreliable, not only for residents, but also for senior surgeons. It appears that the surgical difficulty cannot be accurately estimated preoperatively. The shortcomings of radiography (eg, problems with identification of the root curvature) and unforeseen behavioral issues with individual patients (eg, maintaining the mouth opening) should be considered in the delineation of the difficulty of third molar removal.

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