# Is it Possible to Predict the Difficulty of Third-Molar Surgical Extraction?

## Medical Science

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**ABSTRACT**

*The goal of this study was to identify a factor or a group of factors, which can be used in daily clinical practice to predict the difficulty of third-molar (M3) surgical extraction.*

*Here we present a prospective cohort study conducted on 100 patients consecutively referred by their primary health care dentists.*

*Six preoperative radiological variables were analyzed in order to identify which ones could be used for preoperative evaluation of surgical difficulty on the basis of surgical time (ST) and osteotomy time (OT).*

*Statistical analysis showed that the M3 position relative to the anterior border of the ramus (ABR) and the Winter's distance (WD) were enough for preoperative estimation of ST and OT. This finding renders evaluation of other parameters described in the literature unnecessary.*

## Introduction

Extraction of a mandibular third molar (M3) is one of the commonest surgical procedures in Oral and Maxillofacial Surgery. Currently, abundant literature is available on the study of extraction-related variables, which may influence the difficulty, pharmacological treatment and postoperative complication index. However, scarce studies have been published on covariance analysis models aimed at predicting the extraction time as a function of difficulty and chance of complications, independently of the surgeon's ability.

The goal of this study was to identify a factor or a group of factors, which can be used in daily clinical practice to predict the difficulty of third-molar (M3) surgical extraction.

## Patients and method

Here we present the results of a prospective cohort study conducted on 100 consecutive patients, referred to the Oral Surgery Service of the Hospital Universitario Insular de Las Palmas de Gran Canaria by their primary health care dentists.

Patients fulfilling any of the following exclusion criteria were not included in the study: patients presenting with acute local infection at the moment of the visit, patients referred for more than one M3 extraction, patients under anti-inflammatory or antibiotic treatment in the last two weeks before operation, patients under anticoagulant or anti-aggregant treatment, patients presenting with any other condition that could influence the results of the study, patients that refused to participate.

All of the interventions were carried out in the same operating room and by the same experienced surgeon. This study was approved by the hospital commission for research, teaching and training.

Preoperative extra-oral panoramic dental x-ray image studies were done with the digital orthopantomography equipment satelec x-mind panod+ and software digora dfw 2.5 R1 (windows).

A number of preoperative radiological variables were considered to estimate surgical difficulty based on ot and st. To that end, a modification of the pell and gregory's method1 was used, where the following six parameters were included.

- Direction of eruption relative to the occlusal plane of molars. The following directions were considered: vertical, mesioangular, horizontal and other, the latter including distoangular and backwards (Fig. 1).
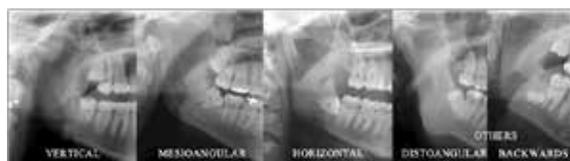


**Figure 1.- Classification of the molars by the direction of eruption**

- Impaction depth included: mild impaction (crown at the same level than the crown of the second molar), moderate impaction (crown below the level of the crown of the second molar) and deep impaction (crown at the level of the root of the second molar) (Fig. 2).



**Figure 2.- Classification of the molars by the impaction depth**

- M3 position relative to the anterior border of the ramus (ABR). Molars were classified into Class I: enough room available between the anterior border of the ascending ramus and the distal plane of the second molar; Class II: mesiodistal diameter of the impacted tooth larger than the distance between the second molar and the anterior border of the ramus, and Class III: no room between the second molar and the anterior border of the ramus; third molar embedded in the ramus (Fig. 3).



**Figure 3.- Molar situation relative to the anterior border of the ramus**

- Winter's distance (WD): Winter[2] described two imaginary

lines: a first line connecting the distal bone to the third mo- lar with the crest of the septum between mandibular first and second molars, and a second line perpendicular to the first one, from the amelocemental junction on the mesial plane of M3s. The latter line indicates impaction depth (Fig. 4).
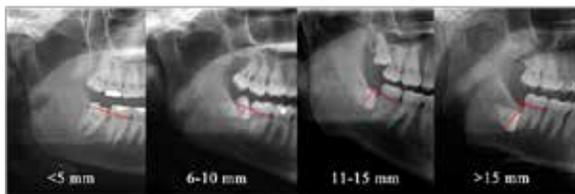


**Figure 4.- Classification of the molars by Winter's distance**

- Proximity and position of M3 roots relative to alveolar nerve canal: classified as separated, in contact or overlapping.
- Root morphology: roots were classified as germ, single root (roots fused together), two or more parallel roots and two or more divergent roots (abnormal roots).

Every variable was assigned a score of 0, 1 or 2 (table 1) and a Scale for Preoperative Evaluation of Surgical Difficulty (SPESD) was created, which ranked from 1 to 12.

**Table 1.- DIFFICULTY EVALUATION SCALE**

| Direction of eruption | Score |
|---|---|
| Vertical | 0 |
| Mesioangular | 1 |
| Horizontal | 2 |
| Depth | |
| Mild impaction | 0 |
| Moderate impaction | 1 |
| Severe impaction | 2 |
| Distance between the second molar and the anterior border of the ramus | |
| Class I | 0 |
| Class II | 1 |
| Class III | 2 |
| Winter's distance | |
| < 5 mm | 0 |
| 6-10 mm | 1 |
| >10 mm | 2 |
| Proximity and situation of the third molar relative to the dental nerve canal | |
| Separated | 0 |
| In contact | 1 |
| Overlapping | 2 |
| Root morphology | |
| Germ, single-root or several roots fused together | 0 |
| 2 or more, parallel or convergent roots | 1 |
| 2 or more, divergent or abnormal roots | 2 |

The total operation time (ST), from the initial incision to the last suture stitch and the time required for bone milling, i.e. osteoto- my time (OT), were recorded in seconds.

Patients were prescribed the following postoperative treatment: 875 mg amoxicillin plus 125 mg clavulanic acid every 8 hours for 5 days, diclofenac (50 mg every 8 hours on the first and second days and every 12 hours on the third day) and oral metamizol magnesium (2-gr vials) depending on the intensity of pain.

### Statistical analysis
Data were collected from the patient's medical records and re- corded on a database, which was created with the Microsoft Ex- cel software and then transferred to the SPSS 20.0 software for statistical analysis.

Categorical variables were expressed as percentages and nu-

merical variables as mean and standard deviation. For compar- ing the means of more than two independent samples, variance analysis with one variation factor (ANOVA) and the Bonferroni's test for multiple comparisons were used. Cluster analysis was used to identify an optimal group of parameters for preopera- tive evaluation of difficulty. Covariance analysis was used to find those parameters, which best discriminate OT and ST as a func- tion of a number of continual or categorical variables. Hypoth- esis contrast was considered to be statistically significant for p- values lower than 0.05.

### Results
We present a series of 100 consecutive extractions of impacted M3s (patients: 62 females and 38 males, average age 24.47 years).

No relationship was found between any of the SPESD factors and age or sex. Analysis of the overall SPESD scores revealed that higher values corresponded to longer OT and ST.

When only the direction of eruption was considered, ST was found to be significantly longer for horizontally impacted molars (385 seconds) than for mesioangularly (228 seconds) or vertically (168 seconds) impacted ones; OT was also significantly longer ($p<0.01$) for horizontal (151 seconds) than for mesioangular (44 seconds) or vertical (10.5 seconds) impaction.

Impaction depth was also closely related with ST. For moderate and deep impaction together, ST was 148 seconds, while for mild impaction it was 83.6 seconds ($p = 0.01$).

Analysis of the distance between the second molar and the an- terior border of the ramus failed to reveal significant ST differ- ences. However, regarding OT, Class I (18.5 seconds) and Class II (54.5 seconds) were statistically equivalent, while Class III (105.2 seconds) was significantly different from Classes I and II ($p = 0.003$).

Analysis of the Winter's distance however, yielded significant differences ($p<0.001$) for all the three groups, both in ST (184.3; 243.6 and 383.7 seconds) and OT (21.4; 49.0 and 153.3 seconds).

Regarding root morphology single-roots and two-parallel roots did not influence ST (221.3 and 232.9 seconds) or OT (37.3 and 52.3 seconds), while divergent (abnormal) roots produced statis- tically significant differences in both ST (320.8 seconds, p=0.040) and OT (116.1 seconds, p<0.001).

### Discussion
Extraction of lower M3 is one of the commonest interventions in the oral cavity. Consequently, a number of studies have been published with the aim of predicting associated difficulty, sur- gical time and complications[3-8], however with widely varying results. The aim of this study was to identify those variables or combinations of variables, out of six analyzed ones, which are most useful for preoperative estimation of surgical difficulty based on ST and OT.

Given that no definitive reference was found in the literature, we used a combination of previously described scales.

The Pell-Gregory[1] scale is one of the most extensively used tools to evaluate the difficulty of M3s extraction. This scale includes impaction depth and position relative to the anterior border of the ramus and the second molar. However, García et al.[9] demon- strated that the Pell-Gregory scale alone is not a reliable predic- tor of surgical difficulty because M3s oriented in directions other than vertical are hard to classify, which reduces the practical ap- plication of the scale.

Diniz-Freitas et al.[10] reported 105 consecutive M3s extractions,

where the Pederson's scale (based on the position of the lower third molar in the x-ray image)11 was used for preoperative evaluation and the Parant's scale12, as modified by García-García9, for postoperative evaluation of surgical difficulty. No significant relationship was found between the Pederson's scale and the duration of surgical intervention. The authors concluded that preoperative evaluation based on the Pederson's scale is not reliable to predict surgical difficulty. However, their results showed that high scores in the Parant's scale were significantly associated with longer ST. Therefore, Diniz-Freitas et al. postulated that prediction of the surgical difficulty associated with extraction of impacted lower M3s should include factors other than mere anatomical position10.

Yuasa et al.3 developed an index based on the following difficulty criteria: relative depth, position relative to the mandibular ramus and, most important, root width. These authors regarded root curvature as an unpredictable factor, which occasionally remains unrevealed in panoramic x-ray.

Some scales, like those proposed by Martínez-González et al.13 or Peñarrocha et al.14, besides including the above described measures of surgical difficulty, also include further variables such as size of the tooth follicle, amount of overlying bone or Winter's distance, to produce a scale that may be regarded as an index (very difficult, difficult or moderately difficult and little difficult). In any case, the final scores used for preoperative evaluation of surgical difficulty are mainly based on preoperative studies of panoramic x-ray images, which according to Chandler & Laskin15 are unreliable for classification of impacted molars.

Barreiro-Torres et al.5 reported that estimations of the surgical difficulty of M3s extraction, based on preoperative panoramic x-ray images and evaluation scales, were poorly correlated with postsurgical outcomes. Furthermore, the experience of observers did not influence the results. However, differently from our study, interventions were not done by one experienced surgeon but by postgraduate students of a Master of Oral Medicine, Oral Surgery and Dental Implantology.

The aim of this study was to find out which ones out of the six considered preoperative parameters, or combinations of them, could be most suitable to estimate surgical difficulty based on ST and OT. To that end, cluster analysis techniques were used and three natural ST and OT clusters were found, namely: a low-difficulty one corresponding to ABR and WD equal to 0; a medium-difficulty one corresponding to ABR and WD equal to 1; and a high-difficulty cluster corresponding to ABR and WD equal to 2. Table 2 shows ST and OT values for these three positions.

**Table 2. ST and OT results with the new scale***

| | Difficulty scale | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Low difficulty | | | Medium difficulty | | | High difficulty | | |
| | n | Mean | Standard deviation | n | Mean | Standard deviation | n | Mean | Standard deviation |
| Surgical time (ST) in seconds | 28 | 142.9 | 41.8 | 52 | 239.7 | 88.3 | 20 | 441.3 | 226.3 |
| Osteotomy time (OT) in seconds | 28 | 3.0 | 5.7 | 52 | 46.7 | 34.1 | 20 | 169.6 | 109.3 |

*Times were significant for all the three situations (p<0.01). Bonferroni's test for multiple comparisons

**Conclusion**

The findings reported in this article lead to the conclusion that an analysis of ABR and WD produces statistically significant results for preoperative estimation of ST and OT, which renders evaluation of any other parameter described in the literature unnecessary.

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