Estimating Third Molar Extraction Difficulty: A Comparison of Subjective and Objective Factors

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Purpose: The purpose of this study was to compare and contrast subjective and objective assessments of variables associated with third molar (M3) extraction difficulty.

Materials and Methods: To address the research purpose we implemented a prospective cohort study and enrolled a sample of surgeons removing M3s in an ambulatory care setting. Predictor variables were categorized as demographic, anatomic, or operative. The outcome variables were subjective and objective rankings of the importance of the variables in terms of estimating M3 extraction difficulty. Subjective rankings were made by surveying the surgeons and asking them to rank each variable's importance on a scale ranging from 0 (not important) to 100 (extremely important). Objective rankings of each variable's importance were made using the absolute values of coefficients derived from a multivariate linear regression model with extraction time as the outcome. Appropriate uni-, bi-, and multivariate statistics were computed.

Results: The sample consisted of 14 surgeons who removed 450 M3s from 150 subjects from June 2002 to August 2003. Based on the multivariate linear regression model, variables associated with M3 extraction time were gender, arch location, Winter's classification, tooth morphology, number of teeth extracted, procedure type, and surgical experience. For these variables, there was a strong, statistically significant correlation ($r = 0.86$; $P < .01$) between the standardized coefficient absolute values and the surgeons' estimates of importance.

Conclusion: There was a large, positive correlation between variables that surgeons consider most important in determining M3 extraction difficulty and those exhibiting the most influence over extraction times in a multivariate model.

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The extraction of third molars (M3s) is among the most common surgical procedures and is a cornerstone of the field of oral and maxillofacial surgery. There is an abundance of literature devoted to variables affecting extraction difficulty, pharmacologic therapies associated with removal, and postoperative complication rates. There is, however, a relative lack of research quantitatively describing the development of multivariate linear regression models for predicting extraction times, and the ability of surgeons to accurately gauge extraction difficulty and risk variable influence over extraction times. We have recently reported the development of quantitative models to predict M3 extraction times and evaluate surgeons' abilities to estimate difficulty.[1,2] These studies have examined the demographic, anatomic, and operative variables associated with M3 extraction difficulty, as measured via extraction time.

The purpose of this study was to compare and contrast subjectively and objectively identified variables postulated to be important in terms of estimating M3 extraction difficulty. We hypothesized that there would be a strong correlation between the variables surgeons considered most important (a "subjective" assessment) and the variables associated with extraction time identified using a multivariate linear regression model (an "objective" assessment). We also hypothesized that the correlation between these assessments would be stronger for senior surgeons versus resident surgeons. The specific aims of this study were: 1) to survey a cohort of surgeons and ask them to identify variables felt to be important in predicting M3 extraction difficulty, 2) to identify variables associated with M3 extraction time using a multivariate model, and 3) to compare and contrast the subjective and objective sets of variables identified as being important predictors of extraction difficulty.

Materials and Methods

STUDY DESIGN/SAMPLE

Our study was designed as a prospective cohort study and we enrolled a sample of surgeons who extracted M3s from a population of patients at the Massachusetts General Hospital Oral and Maxillofacial Surgery Unit (Boston, MA). The sample included resident and attending surgeons who removed M3s in the ambulatory care setting. The sample excluded cases that were treated in the operating room because this is an infrequent occurrence at our institution and in the surrounding community. To reduce observational variance, only cases where the designated observer (S.M.S.) was present were included in the study, thus producing a convenience sample. The institutional review board approved the project.

STUDY VARIABLES AND ANALYSES

The predictor variables were factors postulated to be associated with extraction difficulty. They were chosen on the basis of a literature review, as previously reported, and categorized as demographic, anatomic, or operative.[1-3] The demographic variables were gender, age, ethnicity (Caucasian, African American, East Asian, Hispanic/Latino, South Asian, Pacific Islander/Hawaiian, Native American, or Alaskan Native), and a history of snoring or sleep apnea. The anatomic variables were tooth descriptors (position, morphology, arch location, Winter's classification[4]: vertical, distoangular, mesioangular, horizontal) and gross anatomic descriptors (body mass index, mouth opening, and cheek flexibility). The operative variables were descriptors of anesthetic technique (local, local with N_2O, and intravenous sedation/general anesthesia), type of procedure, number of teeth extracted, and surgical experience. Surgical experience was defined as the number of years since completion of an oral and maxillofacial surgery residency; residents had experience scores <0, attending surgeons had experience scores >0 (eg, an intern in a 6-year program would have an experience score of -6, while a surgeon 1 year out of residency would have an experience score of $+1$).

Several anatomic and operative variables were measured for mandibular teeth only. The anatomic variables were descriptors of tooth position using the Pell-Gregory classification system,[5] tooth angulation, root proximity to the inferior alveolar nerve (IAN) canal, and panoramic radiographic evidence of intimate relationships between root and IAN. The operative variable unique to mandibular M3 extractions was visualization of the IAN in the extraction socket.

The outcome variables were the subjective and objective assessments of each variable's importance in determining M3 extraction difficulty. Subjective assessments of a variable's importance were made by surveying the surgeon. We created a written questionnaire in which each predictor variable was listed and had an associated 100 mm visual analog scale (VAS) (Fig 1). Surgeons were instructed to mark their estimate of the importance of each variable on the 100 mm VAS. A VAS of zero suggests the variable was unimportant. A VAS of 100 suggests the variable was very important. For each variable, the estimate across surgeons was averaged and recorded as the mean estimate of importance (MEI) for that variable. To avoid bias that may arise from the order of the variables on the form, the variables listed on the data sheet were randomly ordered for each surgeon. The MEI scores for resident and attending surgeons were compared for each predictor variable using an independent samples *t* test.

Objective assessments of each variable's importance in determining M3 extraction difficulty were obtained from a multivariate linear regression model developed with extraction time (per tooth) as an outcome. The multivariate linear regression model was constructed by a stepwise elimination method, whereby all predictor variables were included in the model and then iteratively eliminated to produce the most parsimonious model, ie, the model that maximized the R^2 value and minimized the number of variables included in the model.[6] From this finalized model, we used the standardized coefficients as markers of variable influence on extraction time. The standardized coefficient is a quantitative measure of variable influence over extraction time, relative to the other variables in the model. It is computed by dividing the unstandardized coefficients by their respective standard deviations, creating a weighted, dimensionless variable. We constructed 2 multivariate linear regression models: 1 for all teeth in the sample and 1

Instructions: We are investigating the factors that surgeons consider important when assessing the difficulty of third molar (M3) extractions. Each variable listed on the following pages has a 100mm Visual Analog Scale (VAS) associated with it. Please indicate, on the VAS, your opinion regarding the RELATIVE importance of each factor in assessing the overall difficulty of an M3 extraction.

Sex

Not Important — Extremely Important

Age

Not Important — Extremely Important

Body Mass Index (i.e. height/weight ratio)

Not Important — Extremely Important

Ethnicity

Not Important — Extremely Important

A history that the patient snores

Not Important — Extremely Important

A history positive for sleep apnea

Not Important — Extremely Important

Arch Location (i.e. maxilla vs. mandible)

Not Important — Extremely Important

Mandibular Tooth Angulation (i.e. angle between long-axis of tooth and occlusal plane)

Not Important — Extremely Important

Mouth Opening (interincisal distance)

Not Important — Extremely Important

Cheek Flexibility

Not Important — Extremely Important

Surgical Experience (years since completing residency)

Not Important — Extremely Important

Number of M3s extracted (1 – 4)

Not Important — Extremely Important

Type of Procedure (i.e. erupted surgical/non-surgical; impacted – soft tissue, bony)

Not Important — Extremely Important

Type of Anesthesia (i.e. Local, Local + N_2O, IV Sedation)

Not Important — Extremely Important

Intraoperative IAN Visualization

Not Important — Extremely Important

Winter's Classification (Vertical, Horizontal, Distoangular, Mesioangular)

Not Important — Extremely Important

Pell and Gregory Ramus Classification (Class 1, Class 2, Class 3)

Not Important — Extremely Important

Pell and Gregory Occlusal Classification (Level A, Level B, Level C)

Not Important — Extremely Important

Tooth Morphology

Not Important — Extremely Important

Root Proximity to IAN Canal

Not Important — Extremely Important

Panoramic Radiographic Evidence of an intimate anatomical relationship between molar root and IAN canal

Not Important — Extremely Important

FIGURE 1. Sample study questionnaire.

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for mandibular teeth only. The latter model was constructed because some variables (ie, angulation, Pell-Gregory classifications) were pertinent to mandibular teeth only.

We subsequently compared the relationship between the MEI for each variable in the model with the absolute standardized coefficient value using a Pearson correlation. We used the absolute values of the standardized coefficients because we were interested only in the magnitude of the variable influence, not the direction. A P value $\leq .05$ was considered statistically significant.

Results

The sample consisted of 14 surgeons (7 resident; 7 attending) who removed 450 M3s (54.0% mandibular; 43.8% removed by residents) from 150 subjects during the period of June 2002 to August 2003. The mean age for subjects was 25.6 ± 9.8 years; approximately 60% of the subjects were female, 70% Caucasian. The mean extraction time for M3s in the sample was 6.8 ± 7.2 minutes. The mean surgical experience score was 8.7 ± 10.9 years and ranged from −6 (oral and maxillofacial surgery student intern) to 36 (experienced

Table 1. DESCRIPTIVE STATISTICS OF THE STUDY COHORT

Measure*	n = 150 patients and k = 450 teeth
No. of teeth extracted	
Attending surgeons	253 (56.2)
Resident surgeons	197 (43.8)
Demographic variables	
Mean age* (n = 149)	25.6 ± 9.8 (14-65)
Sex† (female) (n = 150)	88 (58.7)
Ethnicity† (caucasian) (n = 150)	105 (70.0)
Snore† (yes) (n = 150)	0 (0.0)
Apnea† (yes) (n = 150)	60 (40.0)
Anatomic variables	
Arch location† (k = 450)	
Maxilla	207 (46.0)
Tooth number† (k = 450)	
1	98 (21.8)
16	109 (24.2)
17	122 (27.1)
32	121 (26.9)
Body mass index* (kg/m^2) (n = 150)	24.2 ± 4.7 (16.9-44.4)
Mouth opening* (mm) (n = 148)	39.1 ± 5.9 (27-60)
Cheek flexibility* (mm) (n = 146)	47.9 ± 7.3 (28-69)
Winter's classification† (k = 450)	
Vertical	277 (61.6)
Distoangular	44 (9.8)
Mesioangular	108 (24.0)
Horizontal	21 (4.7)
Tooth morphology† (k = 45)	
Favorable	376 (83.6)
Unfavorable	74 (16.4)
Pell-Gregory Ramus classification†,‡ ($k_{mandibular}$ = 243)	2.9 ± 1.7 (0-7)
Class 1	48 (19.8)
Class 2	163 (67.1)
Class 3	32 (13.2)
Pell-Gregory Occlusal classification†,‡ ($k_{mandibular}$ = 243)	
Level A	98 (40.3)
Level B	107 (44.0)
Level C	38 (15.6)
Angulation*,† ($k_{imandibular}$ = 243)	67.2 ± 33.6 (0-180)
Root proximity to IAN canal†,‡ ($k_{mandibular}$ = 243)	
Distant	138 (56.8)
Touching	75 (30.9)
Crossing	30 (12.3)
Panoramic radiographic evidence†,‡ ($k_{mandibular}$ = 179)	
Loss of cortical outline	80 (44.7)
Narrowing of canal	7 (3.9)
Deviation of canal	17 (9.5)
Darkening of root	1 (0.6)
No evidence	74 (41.3)
Operative variables	
Number of teeth extracted* (n = 150)	3.0 ± 1.1 (1-4)
Procedure type (k = 450)^2	
Erupted, non-surgical	110 (24.4)
Erupted, surgical	16 (3.6)
Soft-tissue impacted	74 (16.8)
Partial bony impacted	98 (21.4)
Full bony impacted	152 (33.8)
Anesthesia type^2 (k = 450)	
Local	75 (16.7)
Local + N_2O	81 (18.0)
IV sedation/general	294 (65.3)
Inferior alveolar nerve visualized†,‡ (yes) ($k_{mandibular}$ = 241)	11 (4.6)
Surgical Experience* (years) (k = 450)	8.7 ± 10.9 (−6-36)
Outcome variables	
Observed extraction time per tooth* (min) (k = 450)	6.8 ± 7.2 (0.08-44.3)
Preoperative estimate (mm)	42.0 ± 22.2 (2-100)
Postoperative estimate (mm)	38.1 ± 24.6 (1-100)

*Data for continuous variables are reported as mean ± SD (range).

†Data for categorical variables are reported as n or k (%).

‡For mandibular teeth only ($k_{mandibular}$ = 243 teeth).

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oral and maxillofacial surgery attending). Descriptive statistics for the predictor variables are summarized in Table 1.

The MEIs for the predictor variables are summarized in Table 2. MEI scores for demographic, anatomic, and operative variables were 46.7 ± 9.8, 68.9 ± 5.5, and 63.7 ± 8.6, respectively. There were no statistically significant differences between MEI scores for resident and attending surgeons.

MEI scores for individual predictor variables are summarized in rank order in Table 3. Surgical experience had the highest score, followed by procedure type, tooth morphology, arch location, panoramic radiographic evidence of an intimate relationship between the M3 and IAN canal (mandibular teeth only), tooth angulation (mandibular teeth only), mouth opening, root proximity to IAN canal (mandibular teeth only), Pell-Gregory occlusal

Table 2. DESCRIPTIVE STATISTICS FOR SURGEONS' ESTIMATES OF PREDICTOR VARIABLE IMPORTANCE*

Variable	All Surgeons (n = 14)	Attending Surgeons† (n = 7)	Resident Surgeons‡ (n = 7)	P Value§
Demographic variables	46.7 ± 9.8 (33.4-64.2)	47.4 ± 9.9 (33.4-60)	46.0 ± 10.4 (38.6-64.2)	0.89
Age	60.4 ± 19.1 (38.0-95.0)	71.0 ± 19.9 (39.0-95.0)	49.9 ± 11.7 (38.0-74.0)	0.10
Sex	30.3 ± 10.4 (9.0-45.0)	30.1 ± 11.8 (10.0-45.0)	30.4 ± 9.7 (9.0-36.0)	0.54
Ethnicity	55.6 ± 20.6 (5.0-82.0)	52.7 ± 26.2 (5.0-82.0)	58.4 ± 14.8 (40.0-81.0)	0.21
Snore	42.6 ± 21.0 (16.0-77.0)	40.7 ± 20.5 (16.0-69.0)	44.4 ± 22.9 (23.0-77.0)	0.75
Sleep apnea	44.7 ± 21.1 (18.0-87.0)	42.6 ± 19.1 (18.0-71.0)	46.9 ± 24.3 (26.0-87.0)	0.49
Anatomic variables	68.9 ± 5.5 (59.1-78.3)	70.2 ± 3.3 (64.2-74.2)	69.6 ± 7.3 (59.1-78.3)	0.86
Arch location	77.6 ± 9.8 (60.0-94.0)	80.4 ± 10.7 (60.0-94.0)	74.9 ± 8.7 (60.0-86.0)	0.79
Body mass index	50.6 ± 17.4 (11-80)	56.1 ± 15.5 (41.0-80.0)	45.1 ± 18.7 (11.0-72.0)	0.95
Mouth opening	73.0 ± 14.8 (48.0-89.0)	70.0 ± 14.0 (52.0-88.0)	76.0 ± 16.0 (48.0-89.0)	0.78
Cheek flexibility	59.9 ± 13.0 (40.0-89.0)	62.9 ± 16.7 (40.0-89.0)	56.9 ± 7.9 (50.0-72.0)	0.14
Winter's classification	70.4 ± 14.5 (31.0-90.0)	62.4 ± 16.1 (31.0-80.0)	78.4 ± 6.9 (70.0-90.0)	0.12
Tooth morphology	80.1 ± 7.3 (67.0-92.0)	77.7 ± 5.8 (67.0-84.0)	82.4 ± 8.4 (69.0-92.0)	0.33
Angulation	73.1 ± 10.2 (57.0-89)	68.6 ± 10.0 (57.0-88.0)	77.7 ± 8.7 (66.0-89.0)	0.97
Pell-Gregory ramus	68.1 ± 10.7 (47.0-92.0)	70.1 ± 4.3 (64.0-75.0)	66.1 ± 14.9 (47.0-92.0)	0.09
Pell-Gregory occlusal	72.0 ± 10.5 (54.0-89.0)	71.0 ± 10.8 (57.0-89.0)	73.0 ± 10.9 (54.0-85.0)	0.82
Root proximity to IAN canal	72.1 ± 16.8 (37.0-95.0)	73.6 ± 17.5 (37.0-90.0)	70.6 ± 17.4 (48.0-95.0)	0.76
Panoramic radiographic evidence	74.9 ± 21.0 (33.0-98.0)	77.3 ± 21.1 (33.0-98.0)	72.6 ± 22.3 (38.0-94.0)	0.52
Operative variables	63.7 ± 8.6 (47.0-77.2)	58.6 ± 7.6 (47.0-70.5)	68.8 ± 6.4 (59.6-77.2)	0.84
Number of teeth extracted	36.1 ± 19.7 (6.0-67.0)	26.7 ± 16.8 (6.0-51.0)	45.4 ± 18.9 (13.0-67.0)	0.78
Procedure type	81.3 ± 6.0 (71.0-92.0)	79.9 ± 5.5 (74.0-91.0)	82.7 ± 6.6 (71.0-92.0)	0.75
Anesthesia type	56.3 ± 24.7 (9.0-86.0)	46.0 ± 28.8 (9.0-86.0)	66.6 ± 15.6 (33.0-78.0)	0.12
IAN visualization	58.1 ± 10.4 (43.0-78.0)	55.0 ± 5.4 (47.0-63.0)	60.4 ± 13.1 (43.0-78.0)	0.28
Surgical experience	86.1 ± 5.1 (77.0-93.0)	83.1 ± 3.5 (77.0-87.0)	89.0 ± 4.9 (81.0-93.0)	0.08

*Data are reported as mean ± SD (range) on a 100 mm visual analog scale (VAS). Larger values are associated with increased importance of the variable in estimating M3 extraction difficulty.

†Mean surgical experience score for attendings: 23.1 ± 10.8 (6.0-36.0).

‡Mean surgical experience score for residents: −3.3 ± 2.6 (−6.0-−1.0).

§Attending and resident estimates were compared by an independent samples t test.

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classification, Winter's classification, Pell-Gregory ramus classification, patient age, cheek flexibility, incidence of IAN visualization (mandibular teeth only), anesthetic technique, ethnicity, body mass index, history of sleep apnea, history of snoring, number of teeth extracted, and patient gender.

MULTIVARIATE REGRESSION MODEL FOR ALL TEETH

The most parsimonious multivariate linear regression model for all teeth in the sample, constructed by iterative elimination of candidate variables, included patient gender, arch location, Winter's classification, tooth morphology, number of teeth extracted, procedure type, and surgical experience (Table 4). Pearson correlation analyses of the standardized coefficient absolute values for the predictor variables in this model with the corresponding MEI scores yielded a statistically significant, positive correlation ($r = 0.86$; $P = .01$).

A comparison of the MEI scores for attending surgeons versus the absolute standardized coefficient values showed a statistically significant, positive correlation ($r = 0.85$; $P = .02$). There was also a statistically significant, positive correlation between the MEI scores for residents and the absolute standardized coefficient values ($r = 0.84$; $P = .02$).

MODEL FOR MANDIBULAR TEETH

The most parsimonious multivariate linear regression model for mandibular teeth included tooth morphology, Pell-Gregory ramus classification, number of teeth extracted, procedure type, and surgical experience (Table 5). Bivariate Pearson correlation analysis revealed a positive correlation ($r = 0.67$). This value, however, was not statistically significant ($P = .22$).

Neither the attending ($r = 0.51$; $P = .38$) nor resident ($r = 0.72$; $P = .17$) MEI scores were statistically significantly associated with the absolute standardized coefficient values for the multivariate linear regression model for mandibular M3s.

Discussion

The aim of this study was to determine the relationship, if any, between surgeons' subjective assessments of variables' importance in determining M3 extraction difficulty and the quantitative assessments of variable importance from multivariate linear regression models.

Table 3. RANK ORDERED MEI SCORES FOR PREDICTOR VARIABLES

	Sample	All Surgeons (n = 14)	Attending Surgeons (n = 7)	Resident Surgeons (n = 7)
Rank	1	Surgical experience: 86.1 ± 5.1	Surgical experience: 83.1 ± 5.5	Surgical experience: 89.0 ± 4.9
	2	Procedure type: 81.3 ± 6.0	Arch location: 80.4 ± 10.7	Procedure type: 82.7 ± 6.6
	3	Tooth morphology: 80.1 ± 7.3	Procedure type: 79.9 ± 5.5	Tooth morphology: 82.4 ± 8.4
	4	Arch location: 77.6 ± 9.8	Tooth morphology: 77.7 ± 5.8	Winter's classification: 78.4 ± 6.9
	5	Panoramic radiographic evidence*: 74.9 ± 21.0	Panoramic radiographic evidence*: 77.3 ± 21.1	Tooth angulation*: 77.7 ± 8.7
	6	Tooth angulation*: 73.1 ± 10.2	Root proximity to IAN canal*: 73.6 ± 17.5	Mouth opening: 76.0 ± 16.0
	7	Mouth opening: 73.0 ± 14.8	Patient age: 71.0 ± 19.9	Arch location: 74.9 ± 8.7
	8	Root proximity to IAN canal*: 72.1 ± 16.8	Pell-Gregory occlusal*: 71.0 ± 10.8	Pell-Gregory occlusal*: 73.0 ± 10.9
	9	Pell-Gregory occlusal*: 72.0 ± 10.5	Pell-Gregory ramus*: 70.1 ± 4.3	Panoramic radiographic evidence*: 72.6 ± 22.3
	10	Winter's classification: 70.4 ± 14.5	Mouth opening: 70.0 ± 14.0	Root proximity to IAN canal*: 70.6 ± 17.4
	11	Pell-Gregory ramus*: 68.1 ± 10.7	Tooth angulation*: 68.6 ± 10.0	Anesthetic technique: 66.6 ± 15.6
	12	Patient age: 60.4 ± 19.1	Cheek flexibility: 62.9 ± 16.7	Pell-Gregory ramus*: 66.1 ± 14.9
	13	Cheek flexibility: 59.9 ± 13.0	Winter's classification: 62.4 ± 16.1	IAN visualization*: 60.4 ± 13.1
	14	IAN visualization*: 58.1 ± 10.4	Body mass index: 56.1 ± 15.5	Ethnicity: 58.4 ± 14.8
	15	Anesthetic technique: 56.3 ± 24.7	IAN visualization*: 55.0 ± 5.4	Cheek flexibility: 56.9 ± 7.9
	16	Ethnicity: 55.6 ± 20.6	Ethnicity: 52.7 ± 26.2	Patient age: 49.9 ± 11.7
	17	Body mass index: 50.6 ± 17.4	Anesthetic technique: 46.0 ± 28.8	History of sleep apnea: 46.9 ± 24.3
	18	History of sleep apnea: 44.7 ± 21.1	History of sleep apnea: 42.6 ± 19.1	No. of teeth extracted: 45.4 ± 18.9
	19	History of snoring: 42.6 ± 21.0	History of snoring: 40.7 ± 20.5	Body mass index: 45.1 ± 18.7
	20	No. of teeth extracted: 36.1 ± 19.7	Patient sex: 30.1 ± 11.8	History of snoring: 44.4 ± 22.9
	21	Patient sex: 30.3 ± 10.4	No. of teeth extracted: 26.7 ± 16.8	Patient sex: 30.4 ± 9.7

*Variable recorded for mandibular teeth only.

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We enrolled a cohort of surgeons who removed M3s from a population of patients, and recorded surgeons' estimates of variable importance. We developed multivariate linear regression models based on extraction times and subsequently compared the absolute standardized coefficient values from these models with the MEI scores.

There was a strong, statistically significant correlation between both attending and resident MEI scores and absolute standardized coefficient values for all teeth. These data indicate that surgeons have a good ability to estimate the relative importance of variables that determine M3 extraction times. These results also indicate that surgical experience has very little influence on these estimates. This hypothesis that surgical experience has little influence on surgeons' estimates of variable importance is supported by the fact that there were no statistically significant differences in the MEI scores for any of the study variables between attending and resident surgeons.

It is possible that the similarity in estimates between attending and resident surgeons is the result of predoctoral training that emphasizes certain variables as being more indicative of M3 extraction difficulty. In addition, because our sample includes surgeons and residents at the same postdoctoral program, the resident surgeons we questioned were trained by the attending surgeons in the sample. Therefore, it is feasible that variables that the attending surgeons considered most important were emphasized in the training of resident surgeons.

Our data also indicate that surgeons, both resident and attending, consider anatomic variables the most important in determining extraction difficulty, followed by operative variables, with demographic variables the least important. We recently reported that

Table 4. MULTIVARIATE LINEAR REGRESSION FOR ALL M3s

Variable*	All M3s (k = 450 teeth)			
	Coefficient†	*P* Value	Standardized Coefficient‡	MEI§
Sex	−1.1	.03	−0.08	30.3
No. of teeth extracted	−0.75	< .01	−0.10	36.1
Winter's classification	1.1	< .01	0.15	70.4
Arch location	2.5	< .01	0.17	77.6
Tooth morphology	−5.2	< .01	−0.28	80.1
Surgical experience	−0.19	< .01	−0.29	86.1
Procedure type	1.5	< .01	0.32	81.3
Constant	10.5	< .01	N/A	N/A
R-square	0.54	< .01	N/A	N/A
Pearson correlation‖	N/A	N/A	$r = 0.86$; $P = .01$	

*Variables listed in rank order based on the absolute value of the standardized coefficient.
†Unstandardized linear regression coefficient.
‡Standardized coefficient; measure of effect size.
§Mean estimate of importance of variable in determining extraction difficulty.
‖Pearson correlation between predictor variable MEI values and corresponding standardized coefficient absolute values.

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instances where surgeons' estimates of M3 extraction difficulty were inaccurate were associated with demographic (gender, ethnicity, incidence of snoring) and non-radiographic anatomic (body mass index, cheek flexibility, mouth opening) variables.[2] The results of this study confirm the hypothesis put forth in that study; namely that these variables are associated with instances where surgeons' estimates of difficulty were inaccurate because surgeons consider them less important when estimating M3 extraction difficulty. When the MEI scores for predictor variables were rank ordered, gender, ethnicity, incidence of snoring, body mass index, mouth opening, and cheek flexibility were considered less important than radiographic anatomic variables and operative variables.

Both resident and attending surgeons considered surgical experience to be the most important variable in determining M3 extraction difficulty. This is consistent with our data sample, which shows a statistically significant inverse correlation between surgical experience and extraction time ($r = -0.29$; $P < .01$).

There was no statistically significant correlation between MEI scores and absolute standardized coefficient values from the model for mandibular M3s. These results indicate that, while surgeons can accurately assess the importance of predictor variables in influencing extraction difficulty for all M3s, they do not accurately assess the predictor variable influence for mandibular M3s alone. This is consistent with a hypothesis that surgeons have a good general understanding of the variables that influence M3 extraction difficulty, but a poorer understanding of variables specific to mandibular M3 extractions (ie, Pell-Gregory classifications).

Table 5. MULTIVARIATE LINEAR REGRESSION MODEL FOR MANDIBULAR M3s

Variable*	Mandibular M3s (k = 243 teeth)			
	Coefficient†	*P* Value	Standardized Coefficient‡	MEI§
Pell-Gregory ramus class	2.4	.03	0.16	77.6
No. of teeth extracted	−1.8	< .01	−0.21	36.1
Tooth morphology	−4.9	< .01	−0.26	80.1
Procedure type	1.9	< .01	0.29	81.3
Surgical experience	−0.31	< .01	−0.40	86.1
Constant	14.9	< .01	N/A	N/A
R-square	0.47	< .01	N/A	N/A
Pearson correlation‖	N/A	N/A	$r = 0.47$; $P = .43$	

*Variables listed in rank order based on the absolute value of the standardized coefficient.
†Unstandardized linear regression coefficient.
‡Standardized coefficient; measure of effect size.
§Mean estimate of importance of variable in determining extraction difficulty.
‖Pearson correlation between predictor variable MEI values and corresponding standardized coefficient absolute values.

Susarla and Dodson. Estimating Third Molar Extraction Difficulty. J Oral Maxillofac Surg 2005.

In conclusion, in this study we recorded surgeons' estimates of variable importance in determining M3 extraction difficulty. There was a strong, statistically significant correlation between surgeons' estimates of variable importance and the absolute standardized coefficient values from a multivariate linear regression model. These data suggest that surgeons, independent of surgical experience, accurately assess the importance of variables in determining M3 extraction difficulty.

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