Comparing the Efficiencies of Third Molar Surgeries With and Without a Dentist Anesthesiologist

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Two different anesthesia models were compared in terms of surgical duration, safer outcomes, and economic implications. Third molar surgeries performed with and without a separate dentist anesthesiologist were evaluated by a retrospective data analysis of the surgical operative times. For more difficult surgeries, substantially shorter operative times were observed with the dentist anesthesiologist model, leading to a more favorable surgical outcome. An example calculation is presented to demonstrate economic advantages of scheduling the participation of a dentist anesthesiologist for more difficult surgeries.

Key Words: Oral surgery; Operative time; Dentist anesthesiologist; Third molars; Wisdom teeth; Intravenous sedation.

Intravenous sedation and general anesthesia play an important role in oral and maxillofacial surgery for the treatment of complex surgical cases, pain control, and management of dental phobic patients. Dionne et al¹ estimated that 23 million people in the United States would visit the dentist more often if general anesthesia and conscious sedation were readily accessible. Because oral health declines when patients avoid dental treatment, options for general anesthesia and sedation in dentistry need to be made accessible to a large population in a safe, efficient, and effective manner.^{1,2}

Surgical removal of third molars (M3s) is one of the most common procedures performed by oral and maxillofacial surgeons, and most patients undergoing M3 surgery have a high degree of anxiety.^{3,4} Earl⁴ found that reassurance and adequate pain control are the most important factors for reducing patients' anxiety about M3 surgery. Minimizing postsurgical complications from M3 extractions is another important factor in lowering patients' anxieties and increasing their likelihood for future dental visits.⁵

The operating oral surgeon is commonly responsible for providing both the sedation and surgery in the accepted and conventional standard associated with dentistry.⁶ This traditional model of single-surgeon–provided anesthesia (SSPA), also known as the operator-anesthetist model, has been the mainstay for M3 surgery in oral and maxillofacial practices. Research shows that SSPA can be done safely and results in a low incidence of adverse events.⁷ However, it is important to address concerns about reports that show a likelihood that death or brain injury associated with mode of deep sedation or general anesthesia provided by an oral and maxillofacial surgeon exceeds 1 case per month.⁸ Also, there is continued reluctance among patients regarding dental treatment, and one of the contributing issues may be the failure of current methods to provide access to the many patients requiring outpatient anesthesia in a cost-effective manner.¹

Furthermore, recent cases of anesthesia related deaths in the dental office have prompted interest in safer anesthesia options. In this paper, an alternative anesthesia model is considered that can lower patient anxiety levels and provide a shorter and equally safe, if not safer, surgery.⁹ In this alternative to the SSPA model, a dedicated dentist anesthesiologist is added to the oral and maxillofacial surgery team, and this is called the surgeon and dentist anesthesiologist (SDA) model.

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In the SDA model, the presence of the dedicated anesthesiologist is expected to lower the average operative time of the extraction procedure, which is presumed to allow for improved and safer surgical outcomes. The reduction of operative time limits both surgical exposure and the amount of sedatives received by the patient. Several studies have also shown a direct correlation between shorter procedures and improved postoperative results.^{10–12} Furthermore, a reduction in operative time may lead to decreased patient anxiety. Many surgeons are reluctant to adopt this SDA model as they assume that having a separate dentist anesthesiologist will increase cost and reduce efficiency in the dental setting.

The aim of this study was to assess the efficiency of this alternative method by comparing the intraoperative times for M3 surgery for the SSPA model and the SDA model. The results will help to determine whether SDA is a feasible model in the private practice setting. In the data analysis process, analysis of variance (ANOVA) will be used, and a general linear model (GLM) will be fit to the data and used to control imbalance of potential confounding variables in the data.

Surgical parameters, such as intensity of pain or analgesic use, have been employed previously to compare different anesthesia techniques.¹³ However, the use of operative time as a means of comparing 2 different methods of anesthesia is believed to be more accurate and sensitive to different variables. Operative time is also reported to correlate well with pain intensity, analgesic use, patient anxiety, and postsurgical complications.^{10–12} Hence, in this paper, the measure of operative time was used to evaluate the efficiency of SDA versus SSPA.

METHODS

Study Design

The study design is a retrospective chart review of all patients who underwent M3 extraction procedures during a 12-month period (June 2009–May 2010) at the Triangle Implant Center (Durham, NC). Included in the study were those patients who had all of their M3s (teeth #1, #16, #17, and #32) extracted under IV sedation/general anesthesia without any additional procedures. There were 200 patients that fit the criteria. Out of this subsample, 100 cases were performed with a dentist anesthesiologist (SDA model) and 100 cases were performed with a single operator-anesthetist (SSPA model). The same surgeon performed all extractions in the same facility, eliminating the potential confounding variables of different surgical skills from different surgeons and also different operating environments.

Operative time was measured from the initiation of local anesthesia to the completion of removal of the last M3, including suture placement, if indicated. Patient characteristics collected were age, gender, the results of the radiographic findings, and Current Dental Terminology (CDT) coding based on radiographic findings.

Data Analysis Approach

Descriptive statistics from the data set were generated in order to explore factors that might significantly account for variability in the operative time. Although the design was balanced with respect to the anesthesia approach (SSPA or SDA), that was not the case for patient factors such as gender, age, and the complexity of the surgery. Histograms of the operative time indicated positive skew in the data, or tendency for longer operative times, rather than shorter. The natural logarithm transformation was used to transform the data, based on the Box-Cox method.

In order to represent surgical complexity as a factor in the GLM, a prior estimate of surgical complexity was categorized into 3 levels of difficulty using CDT coding available prior to each surgery.

The fitting of the GLM was performed using the ANOVA, GLM programs within Minitab 17.

Overall Descriptive Statistics for Study Variables

Patient and anesthesia charts were reviewed for each case that fit the criteria. Along with patient age and gender, dental variables were also collected, including the anatomical position of each M3 and its corresponding complexity, which was based on preoperative assessment of panoramic radiographs and CDT coding guidelines. Each M3 was categorized as either erupted, soft tissue impacted, partially bony impacted, or fully bony impacted. Operative time was measured as described above. Some relevant descriptive statistics for these data are provided in Table 1. Additional quantitative features of the experimental data are presented next, mainly for descriptive purposes.

Results: Operative Time

The operative times for SDA and SSPA were compared as a beginning for the analysis. Their means and standard deviations are provided in Table 2 and histograms are presented in Figure 1.

Table 1. Descriptive Statistics for Patients and Operations in Study*

Variables	Categories	All (<i>n</i> = 200 Patients, <i>k</i> = 800 Teeth)	SDA (<i>n</i> = 100 Patients, <i>k</i> = 400 Teeth)	SSPA (<i>n</i> = 100 Patients, <i>k</i> = 400 Teeth)
Patient (<i>n</i> = 200)	Gender			
	Female, No. (%)	123 (61.5)	59 (29.5)	64 (32.0)
	Male, No. (%)	77 (38.5)	41 (20.5)	36 (18.0)
	Age, y			
	Mean	21.9	22.2	21.6
	SD	5.83	6.26	5.38
	Range	14–43	14–43	14–37
	≤7, No. (%)	43 (21.5)	21 (10.5)	22 (11.0)
	18–20, No. (%)	65 (32.5)	29 (14.5)	36 (18.0)
	21–25, No. (%)	45 (22.5)	26 (13.0)	19 (9.5)
	≥26, No. (%)	47 (23.5)	24 (12.0)	23 (11.5)
Dental (<i>k</i> = 800)	Radiographic findings			
	Erupted, No. (%)	268 (33.5)	153 (19.1)	115 (14.4)
	Soft tissue impacted, No. (%)	3 (0.375)	1 (0.125)	2 (0.250)
	Partially bony impacted, No. (%)	185 (23.1)	85 (10.6)	100 (12.5)
	Fully bony impacted, No. (%)	344 (43.0)	161 (20.1)	183 (22.9)
Operative (<i>n</i> = 200)	Actual operation time, min			
	Mean	16.3	14.7	17.9
	SD	9.60	7.4	11.2
	Range	3–65	3–31	5–65
	≤7.5, No. (%)	33 (16.5)	20 (10.0)	13 (6.5)
	7.5–12.5, No. (%)	52 (26.0)	26 (13.0)	26 (13.0)
	12.5–22.5, No. (%)	73 (36.5)	39 (19.5)	34 (17.0)
	22.5–32.5, No. (%)	33 (16.5)	15 (7.5)	18 (9.0)
	≥32.5, No. (%)	9 (4.5)	0 (0)	9 (4.5)

* SDA indicates surgeon and dentist anesthesiologist; SSPA, single-surgeon–provided anesthesia.

Results: Patient Gender and Age

The gender of the patients was predominantly female, and the data indicated that their mean actual operative time was somewhat shorter than that of male patients (Table 2). Also, younger patients had shorter mean actual operative times than older patients. The histograms in Figures 2 and 3 show evidence of a

Table 2. Descriptive Statistics for Actual Operative Time (min) Versus Anesthesia Method, Patient Gender, and Age*

Category	Count	Mean	SD	Median	Maximum
SDA	100	14.7	7.41	13	31
SSPA	100	17.9	11.19	15	65
Female	123	15.6	8.94	13	48
Male	77	17.5	10.53	16	65
Younger (≤25)	153	15.6	8.28	14	46
Older (>25)	47	18.6	12.87	15	65

* SDA indicates surgeon and dentist anesthesiologist; SSPA, single-surgeon–provided anesthesia.

Figure 1. Frequency histograms of operative times for surgeon and dentist anesthesiologist (SDA) and single-surgeon–provided anesthesia (SSPA) methods.

Figure 2. Frequency histograms of operative times by gender.

Figure 3. Frequency histograms of operative times by age.

positive skew in the operative time data. The Anderson-Darling test rejected the normal distribution for operative time data in Figures 1, 2, and 3. Imbalance in the numbers of patients by gender and age was addressed with a GLM.

Method for Prior Estimation of Complexity of Surgery and Comparison to Study Population

One experienced surgeon estimated the typical operative time for each type of tooth extraction, based on its anatomical position (upper, lower) and CDT coding guidelines: erupted, soft tissue impacted, partially bony

Table 3. Prior Estimates of the Operative Time (min) for 8 Types of Surgeries*

Tooth	E	STI	PBI	FBI
#1, #16 (upper)	3.58	3.83	4.92	5.58
#17, #32 (lower)	3.83	4.38	5.17	7.00

* E indicates erupted; STI, soft tissue impacted; PBI, partially bony impacted; and FBI, fully bony impacted.

impacted, or fully bony impacted. Table 3 presents the 8 operative times that were estimated for each type of extraction. These were used to make a prior estimate of the total surgery time for each patient in the study. For example, if the patient's 4 molars were categorized as upper erupted, upper soft tissue impacted, lower partially bony impacted, and lower fully bony impacted, the time estimates would be 3.58, 3.83, 5.17, and 7.00, resulting in a prior estimate of 19.58 minutes for total operative time.

The prior estimates were compared to the actual operative times for each of the 200 cases. A scatter plot is given in Figure 4 along with the line for the simple regression with a statistically significant coefficient of 0.96 (P value < .001) for the prior estimate:

Mean operative time (min)

$$= -3.5 + (0.96) \times \text{prior estimate (min)}.$$

The scatter of observations about this regression line is very large, with R^2 (adjusted) of 14.6%; using only the prior estimate, less than one sixth of the variability can be explained. The equation suggests that the average operative time is roughly 3.5 minutes less than the prior estimate.

Figure 4. Actual operative times versus prior estimate of histograms of operative time for each patient.

Table 4. Descriptive Statistics for Actual Operative Time (min) Versus SDA and SSPA, Age, and Surgery Difficulty

<i>Anesthesia</i>	<i>Age</i>	<i>Surgery Difficulty</i> [†]	<i>Count</i>	<i>Mean</i>	<i>SD</i>	<i>Maximum</i>
SDA	All included	All included	100	14.7	7.41	31
SSPA	All included	All included	100	17.9	11.19	65
SDA	Younger (≤ 25)	All included	76	14.5	7.11	31
SSPA	Younger (≤ 25)	All included	77	16.8	9.19	46
SDA	Older (> 25)	All included	24	15.5	8.39	30
SSPA	Older (> 25)	All included	23	21.8	15.84	65
SDA	All included	Low	36	12.6	6.91	28
SSPA	All included	Low	30	9.9	4.31	20
SDA	All included	Medium	26	13.5	8.17	30
SSPA	All included	Medium	27	19.6	13.02	65
SDA	All included	High	38	17.5	6.56	31
SSPA	All included	High	43	22.5	10.44	48
All included	Younger (≤ 25)	Low	39	10.8	5.47	25
All included	Older (> 25)	Low	27	12.3	6.67	28
All included	Younger (≤ 25)	Medium	40	13.1	6.53	29
All included	Older (> 25)	Medium	13	25.9	16.84	65
All included	Younger (≤ 25)	High	74	19.3	8.72	46
All included	Older (> 25)	High	7	29.3	8.86	48

* SDA indicates surgeon and dentist anesthesiologist; SSPA, single-surgeon–provided anesthesia.

[†] Categories are based on a prior estimate of operating time based on Current Dental Terminology data: low difficulty corresponds to a prior estimate < 18.3 minutes, medium corresponds to an estimate ≥ 18.3 minutes and < 22.3 minutes, and high corresponds to an estimate ≥ 22.3 minutes. See Methods section for details.

Although the prior estimate in minutes might have been used as a covariate in a GLM, surgery complexity was ultimately represented categorically to allow straightforward interpretation of model results. The low difficulty category refers to 33% of the cases where the prior estimate was less than 18.3 minutes. Medium difficulty refers to 26.5% of the cases with a prior estimate between 18.3 minutes and 22.3 minutes. High difficulty refers to the remaining 40.5% of the cases with a prior estimate greater than 22.3 minutes.

Using the categories for the prior estimate of surgery complexity, descriptive statistics for actual operative time data are presented for subgroups that anticipate possible interaction effects (Table 4). Gender was not included because subsequent analysis determined that its main effect and interactions were not statistically significant. Several of the subgroup means for actual operative time seemed substantially different, such as SDA, medium difficulty, versus SSPA, medium difficulty, and younger, high difficulty, versus older, high difficulty. Some mean comparisons will be presented after a GLM has been fit to the data.

RESULTS OF DATA EVALUATION

Overall Data

The patients were predominantly female, healthy, and less than 25 years old (Table 1). The CDT guideline data

indicated that 33.5% of the teeth were erupted and 43% were fully bony impacted; therefore, 76.5% of the teeth were at the low and high ends of the distribution for the complexity of the surgery. Table 2 compares observed mean operative time by age, gender, and anesthesia and Table 4 shows operative time comparisons for further subgrouping of the data. No conclusions can be drawn until statistical significance of the main effects and interactions are established with ANOVA.

ANOVA/GLM Results

A natural log transformation was applied to the operative time with the result that the residuals had a normal distribution and constant variance. A GLM for the transformed operative time was fit to the data using these factors: anesthesia model, gender, age, and surgery complexity.

Gender was not statistically significant as a main effect ($P = .14$), nor was its interaction with other factors (P values $> .20$). The interaction between anesthesia method and age was not statistically significant ($P = .34$), nor was the third-order interaction between anesthesia method, age, and surgery difficulty ($P = .60$). The factors ultimately included in the model are given in Table 5 along with P values and the percentage of variation explained. For this reduced model, the $R^2 = 31.8\%$ and the R^2 (adjusted) = 29.0%.

Table 5. General Linear Model Results for Statistically Significant Factors and Interactions*

<i>Factor</i>	<i>P</i>	<i>Variation Explained, %</i>
Surgery difficulty	<.001	19.2
Age	<.001	5.0
Anesthesia (SDA/SSPA)	.045	2.1
Anesthesia-difficulty interaction	.007	3.5
Age-difficulty interaction	.049	2.2

* $R^2 = 31.8\%$; R^2 (adjusted) = 29.0%. SDA indicates surgeon and dentist anesthesiologist method; SSPA, single-surgeon–provided anesthesia method.

Mean operative time estimates from the reduced model with statistically significant second-order interaction terms are given in Table 6. Mean comparisons will focus only on the interaction between anesthesia and surgery complexity. The statistical tests of the mean comparisons are performed with the GLM fitted means from the transformed data; the results are in Table 7. For low-difficulty cases, SDA took 1.6 minutes longer, although this difference was not significant ($P = .19$). For medium-difficulty cases, SSPA took 6.3 minutes longer and this difference was significant ($P = .003$). For high-difficulty cases, SSPA took 4.1 minutes longer, and the P value of .087 suggests that a larger sample size might result in statistical significance for that comparison.¹⁴ After these statistical tests were performed with the transformed data, 95% CIs were calculated for such comparisons with the original data. The logarithm transformation results in the difference in means for the transformed data becoming a ratio of the medians of the original data (Table 7).

DISCUSSION

Operative Time

From Table 1, it may have been tempting to conclude that the mean of actual operative time is 3.2 minutes longer for SSPA, because a t test would indicate that the difference in the observed means is statistically significant ($P = .02$). However, it can be seen in Table 4 that SSPA happened to have fewer low-difficulty and more high-difficulty cases than SDA, which would tend to make the SSPA actual operative time longer than if difficulty had been balanced. Including the interaction of anesthesia with the prior estimate of surgical difficulty provides a more reliable estimate of the effect of anesthesia on operative time. Performing a double-blind study to remove any bias related to the presence, or lack thereof, of a dentist anesthesiologist would

Table 6. GLM Estimates for Mean Operative Times by Surgery Complexity, Age, and SDA Versus SSPA*

<i>Anesthesia</i>	<i>Age</i>	<i>Surgery Difficulty</i>	<i>Estimated Mean, min</i>	<i>SE</i>
	Younger (≤ 25)	Low	9.5	0.78
	Older (> 25)	Low	10.6	0.99
	Younger (≤ 25)	Medium	12.0	0.93
	Older (> 25)	Medium	21.3	2.85
	Younger (≤ 25)	High	17.4	0.98
	Older (> 25)	High	27.2	5.01
SDA		Low	10.9	0.88
SSPA		Low	9.3	0.83
SDA		Medium	13.1	1.32
SSPA		Medium	19.5	2.00
SDA		High	19.9	2.32
SSPA		High	23.9	2.49

* GLM indicates general linear model; SDA, surgeon and dentist anesthesiologist; and SSPA, single-surgeon–provided anesthesia.

provide useful data to support this analysis. However, it is virtually impossible to do so and maintain a safe anesthetic and surgical environment for the patients subjected to the study.

Patient Gender

Table 2 shows that females had a mean actual operative time that was 1.9 minutes shorter than that for males. Operative times for M3 surgeries have a well-reported correlation to gender. Renton et al² reported that female patients required shorter duration surgeries for M3 extractions. Shorter operative times for female patients are possibly due to lower bone density in female patients, which allows for an easier separation of the tooth from the bone. In this study, however, that gender did not turn out to be statistically significant.

Patient Age

Patients who were 25 years old or younger had a mean actual operative time that was 3.0 minutes shorter than that for the older patients. Previous literature reports shorter operative times observed for younger patients.^{15–17} According to de Boer, as the erupted molars in older patients have been used for mastication for longer periods of time, they are likely to have firmly developed and attached periodontal ligaments, therefore requiring more force (and time) to remove.¹⁵ In contrast, younger patients have more resilient osseous structures, which makes the surgical removal easier. Bruce et al¹⁶

Table 7. Mean Comparisons of GLM Estimated Mean Operative Times*

<i>Mean Comparison</i>	<i>Difference (min)</i>	<i>P</i>	<i>95% CI for Median Ratio</i>
SDA, low difficulty – SSPA, low difficulty	1.6	.19	(0.924, 1.49)
SDA, medium difficulty – SSPA, medium difficulty	–6.3	.003	(0.518, 0.877)
SDA, high difficulty – SPA, high difficulty	–4.1	.087	(0.670, 1.028)

* GLM indicates general linear model; SDA, surgeon and dentist anesthesiologist; and SSPA, single-surgeon–provided anesthesia.

reported that patients under 25 years had the shortest operative times for M3 surgeries. This study showed that age was statistically significant both as a main effect and as an interaction with surgery difficulty. Including the interaction provides a better way to understand the role of patient age as it affects operative time.

Prior Estimation of Complexity of Surgery

The CDT data were cumbersome to use as a prior estimate of surgery complexity in a GLM, so a new method was developed to obtain a quantitative metric for surgery complexity (see Methods). In Figure 4, the variation in actual operative times for each prior estimate is seen as very large, giving an indication of inherent variation that is perhaps a feature of such surgeries, but the regression line follows the mean of the actual operative times closely. Although it may have increased the variability within the groups and made it more difficult to obtain significance, the introduction of 3 categories for surgery complexity allows straightforward interpretation of model results.

If this approach were used to compare the efficiency of anesthesia approach in a practice other than the Triangle Implant Center, the 8 estimates in Table 3 would need to be changed to reflect a particular surgeon. It is noted that the idea of obtaining a typical task completion time estimate by eliciting an optimistic (10th percentile) and pessimistic (90th percentile) estimate from an experienced surgeon is borrowed from the Project Evaluation and Review Technique.⁵ Other methods that could provide a prior estimate of surgery difficulty could be investigated to find alternatives to what was done here.

ANOVA/General Linear Model

The model had an $R^2 = 31.8\%$ and an adjusted $R^2 = 29.0\%$, which leaves much of the observed variation in operative time unexplained. Nonetheless, the mean

differences estimated from the model suggest some sizeable differences (Table 7).

The 95% bounds on the ratios of median operative times in Table 7 may deserve some interpretation. For low-difficulty cases, the median operative time for SDA lies between 0.92 and 1.49 times the median operative time for SSPA; thus, the median SDA time is generally longer. For medium difficulty, the bounds for median SDA are 0.52–0.88 times the median for SSPA, so the median time with SDA is substantially shorter. For high difficulty, the bounds are from 0.67 to 1.03 times the median SSPA, indicating that SDA results in a shorter median time. The exclusion of 1.0 from CIs for median ratios for the original data indicates significance. For mean differences of the transformed data, the exclusion of zero from CIs indicates significance.

Efficiency Implications for Scheduling SDA and SSPA

The GLM estimates in Table 6 can be used to evaluate some scheduling opportunities for SDA, using the same data from the experiment collected at Triangle Implant Center. Because there is no advantage for SDA over SSPA when the patients have a low-difficulty surgery (33% of the cases), we assume that a dentist anesthesiologist would not need to be present for those surgeries. However, a dentist anesthesiologist participation for medium- and high-difficulty surgeries (26.5 and 40.5% of the cases, respectively) may be beneficial from a time-management perspective.

If the total time dedicated annually to this kind of surgery is T minutes, then the number of these surgeries that could be performed annually with SSPA can be approximated using the estimated means from Table 6:

$$\begin{aligned} &\text{number of surgeries (SSPA only)} \\ &= (0.33T/9.3) + (0.265T)/19.5 + (0.405T)/23.9 \\ &= 0.0660T. \end{aligned}$$

If SDA were used for the medium- and high-difficulty cases, then the number would be approximated as

$$\begin{aligned} &\text{number of surgeries (SDA and SSPA)} \\ &= (0.33T/9.3) + (0.265T)/13.1 + (0.405T)/19.9 \\ &= 0.0761T. \end{aligned}$$

This suggests that 0.0101T additional surgeries could be performed annually. To take this example further, assume that an average of 1 day per week with 6 hours of surgical time would be dedicated to 4-M3 surgeries. Then an estimate of the annual number of additional surgeries is nearly 182 surgeries:

$$\begin{aligned} &(50 \text{ days per year}) \times (360 \text{ minutes per day}) \\ &\times (0.0101) = 181.8. \end{aligned}$$

The specific parameters for practices other than Triangle Implant Center could be used to estimate the expected economic benefit for utilizing SDA in this way. This benefit would be compared with the cost of a dentist anesthesiologist participating at times when medium- and high-difficulty surgeries are deliberately scheduled.

Overall Comparison of SDA Versus SSPA

The retrospective study of actual operative times reveals a great deal of seemingly inherent variation for the 4-M3 surgery. Despite this, several factors were found to be related to statistically significant shifts in mean operative times, including anesthesia method, patient age, and a prior estimate of the surgery. These main effects are accompanied by 2 statistically significant interactions: between anesthesia method and difficulty, and between patient age and difficulty. A mean comparison study of the interaction between anesthesia method and difficulty revealed that, for medium-difficulty cases, SDA results in shorter mean operative times for the logarithmically transformed data and therefore shorter median operative times for the original data. With a larger sample size, the statistical significance might be shown for high-difficulty cases, as well.

Using some assumptions for a hypothetical practice, and assuming that SDA is used for surgeries that are of medium and high difficulty, considerable positive potential economic impact is demonstrated. The approximate calculations presented here can be modified to represent practices that differ from the one assumed for the example.

CONCLUSIONS

Operative time for third molar surgery can be reduced when the surgeon-dentist anesthesiologist model is employed for medium- and high-difficulty cases. The

significant decrease in operative time for the surgeon-dentist anesthesiologist model can be expected to be associated with decreased postsurgical pain and complications.

These findings indicate that the surgeon-dentist anesthesiologist model is an efficient alternative method to the single surgeon provided anesthesia (operator-anesthetist) model, especially for more complex surgeries.

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