Office-Based Ambulatory Anesthesia: Outcomes of Clinical Practice of Oral and Maxillofacial Surgeons

David H. Perrott, DDS, MD, MBA, Judy P. Yuen, MA,†*
Randi V. Andresen, BS,‡ and Thomas B. Dodson, DMD, MPH§

Purpose: The delivery of office-based ambulatory anesthesia services is an integral component of the daily practice of oral and maxillofacial surgeons (OMSs). The purpose of this report was to provide an overview of current anesthetic practices of OMSs in the office-based ambulatory setting.

Materials and Methods: To address the research purpose, we used a prospective cohort study design and a sample composed of patients undergoing procedures in the office-based ambulatory setting of OMSs practicing in the United States who received local anesthesia (LA), conscious sedation (CS), or deep sedation/general anesthesia (DS/GA). The predictor variables were categorized as demographic, anesthetic technique, staffing, adverse events, and patient-oriented outcomes. Appropriate descriptive and bivariate statistics were computed as indicated. Statistical significance was set at ≤.05.

Results: The sample was composed of 34,191 patients, of whom 71.9% received DS/GA, 15.5% received CS, and 12.6% received LA. The complication rate was 1.3 per 100 cases, and the complications were minor and self-limiting. Two patients had complications requiring hospitalization. Most patients (80.3%) reported some degree of anxiety before the procedure. After the procedure, 61.2% of patients reported having no anxiety about future operations. Overall, 94.3% of patients reported satisfaction with the anesthetic, and more than 94.7% of all patients would recommend the anesthetic technique to a loved one.

Conclusion: The findings of this study show that the office-based administration of LA, CS, or DS/GA delivered via OMS anesthesia teams was safe and associated with a high level of patient satisfaction.

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*Principal Investigator and Chair, Outcomes Committee, American Association of Oral and Maxillofacial Surgeons, Rosemont, IL and Vice President of Medical Affairs, Salinas Valley Memorial Healthcare System, Salinas, CA.

†Formerly, Research Associate, American Association of Oral and Maxillofacial Surgeons, Rosemont, IL.

‡Associate Executive Director, American Association of Oral and Maxillofacial Surgeons, Rosemont, IL.

§Member, Outcomes Committee, American Association of Oral and Maxillofacial Surgeons; Associate Professor, Department of Oral and Maxillofacial Surgery, Harvard School of Dental Medicine; Visiting Oral and Maxillofacial Surgeon, Unit Chief, and Director of Resident Training, Department of Oral and Maxillofacial Surgery Massachusetts General Hospital, Boston, MA.

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Address correspondence and reprint requests to Dr Perrott: Vice President of Medical Affairs, Salinas Valley Memorial Healthcare System, 450 E Romie Ln, Salinas, CA 93901; e-mail: dperrott@svmh.com

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Since the administration of nitrous oxide by Horace Wells, DDS, in 1842 and the administration of general anesthesia using ether at Massachusetts General Hospital (Boston) by William T.G. Morton, DDS, dentistry has had a rich history in the administration of anesthesia. In the late 1930s, Hubbell and Krogh introduced and instructed oral and maxillofacial surgeons (OMSs) in the use of thiopental. Since then, the administration of sedation and general anesthesia in the office setting has been a hallmark of the specialty.[1]

To document the quality and safety of anesthesia care provided in the oral and maxillofacial surgery office-based ambulatory setting, authors have used retrospective study designs and data sources that include surveys or malpractice claims analyses. These studies found the mortality rate from the administration of anesthesia in these settings improved with the introduction of modern anesthetic agents and techniques. The reported adjusted mortality rate ranged from 6.1 to 1.0 per 1 million cases.[2-11] Of note, most of the studies reported an adjusted mortality rate of 2.0 or fewer per 1 million cases. Likewise, there has been a reduction in the occurrence of adverse outcomes such as laryngospasm, dysrhythmia, hypoxia, and phlebitis, with the most recent occurrence rate of less than 1%.[2,8,9]

Although these studies have provided important data, the use of retrospective study designs and survey or malpractice claims as data sources introduces biases that cannot be eliminated or controlled. Also, there were no attempts to validate the data, nor were patient-oriented outcome data collected or reported. Prospective office-based anesthesia studies reported to date are often limited to analyses and comparison of anesthetic agents or techniques. In addition, these studies generally have small study samples, such as fewer than 100.[10,11] Although these studies support the efficacy and safety of office-based anesthesia services, there remains a need for a system to collect prospective data from a large patient population undergoing the administration of anesthesia in the oral and maxillofacial surgery office–based ambulatory setting. In addition, the data elements should be validated and collected in conjunction with patient-oriented outcome data. Given the limitations of the studies currently available, the purpose of this report was to provide an overview of the daily anesthetic practice of OMSs in the office-based ambulatory setting.

Materials and Methods

OVERVIEW

The overarching goal of the Oral and Maxillofacial Surgery Outcomes System commissioned by the American Association of Oral and Maxillofacial Surgeons (AAOMS) and conducted in partnership with Outcomes Sciences, Inc (Boston, MA) was to establish a specialty-specific data repository for tracking national practice trends, estimating risk-adjusted outcomes of care, and determining associations between alternative processes of care and outcomes of care. For the purposes of this study on office-based ambulatory anesthesia service provided by OMSs, the data, collection materials, and methods were developed in the alpha and beta testing phases conducted in 2000. The AAOMS *Parameters of Care* document was used as a guideline by the AAOMS Outcomes Committee in conjunction with 2 database management vendors—Covance (Washington, DC), and Outcomes Sciences, Inc (Boston, MA)—to develop objectives and goals for the data collection instruments used in the alpha and beta testing.[12,13] The alpha phase tested the utility and completeness of the data collection instruments. The beta phase involved pilot testing of the data collection system in active clinical practices. A detailed discussion of the development and testing results of the Oral and Maxillofacial Surgery Outcomes System was previously published.[14]

STUDY DESIGN/SAMPLE

To address our research goals, we designed a prospective cohort study. The study sample was composed of a consecutive series of patients derived from the population of patients who underwent oral and maxillofacial surgery outpatient procedures between January 2001 and December 2001 in the United States. Eligible patients included all individuals who underwent oral and maxillofacial operative procedures in the office-based ambulatory setting involving local anesthesia, conscious sedation, or deep sedation/general anesthesia (DS/GA). Eligible office-based ambulatory settings included community-, dental school–, or hospital-based practices. There were no exclusion criteria for patients.

The OMSs selected to be in the study were composed of volunteers derived from the population of OMSs practicing in the United States during the study interval. To be eligible for study enrollment, the OMS participants had to 1) be an AAOMS member and agree to submit demographic, clinical, and patient satisfaction data to the AAOMS national data repository for all patients for whom they performed an operative procedure in an outpatient setting, involving local anesthesia, conscious sedation, or DS/GA, 2) have Internet access, and 3) treat patients in an office-based ambulatory setting. The investigators strove to obtain regional representation from the 6 AAOMS districts (district I, northeast; district II, mid-Atlantic; district III, southeast; district IV, midwest; district V, southwest-mountain; district VI, Pacific Coast and western). A total of 79 surgeons in 58 sites participated in the study. The distribution of the study sites grouped by AAOMS district was I (n = 6), II (n = 3), III (n = 14), IV (n = 7), V (n = 14), and VI (n = 14). As indicated, each site obtained appropriate Human Research Committee approval.

Data collected for each participating surgeon included name, years in practice, and board certification status. The participating surgeons mean length of practice was 15 years (range, 1 to 36 years). Ninety-one percent of surgeons were board certified, and the mean duration since certification was 12 years (range, 1 to 37 years). Of 58 sites, 47 sites reported that their state Dental Practice Act or OMS Society required an onsite evaluation for office-based anesthesia. Ten sites (17%) were accredited by the Accreditation Association for Ambulatory Health Care (AAAHC), and 4 (7%) were accredited by Joint Commission on Accreditation of Healthcare Organization (JCAHO), and 42 sites (72%) had no or pending JCAHO/AAAHC accreditation.

STUDY VARIABLES

The predictor variables were categorized as demographic, anesthetic technique, staffing, adverse events, and patient-oriented outcomes. Demographic variables included age, gender, anesthetic risk, and operative procedure. Anesthetic risk was classified using the American Society of Anesthesiology (ASA) system.[15] ASA status ranges from I (healthy, minimal risk) to V (moribund, will not survive without an operation, poor risk). Anesthetic technique and staffing variables include the types and frequencies of perioperative medications, airway management, peripheral access, staffing, and monitoring techniques. The anesthesia team was defined as the personnel in the procedure room during the procedure that participated in the anesthesia administration or management. The surgical team was defined as the personnel in the procedure room who participated in the operative management of the patient. The types and frequencies of intraoperative and postoperative anesthetic adverse events were documented. Patient-oriented outcome variables included intraoperative pain control, recall, satisfaction, and anxiety relief.

The major outcome variable of interest was anesthetic technique, grouped into 3 categories: local anesthesia alone, conscious sedation, and DS/GA. Local anesthesia was defined as the elimination of sensation, especially pain, in one part of the body by the topical application or regional injection of a drug. No other adjunctive agents were used to relieve anxiety. Conscious sedation was defined as a minimally depressed level of consciousness that retains the patient's ability to independently and continuously maintain an airway and respond appropriately to physical stimulation or verbal command and that is produced by a pharmacologic or nonpharmacologic method or a combination thereof. DS and GA patients were combined for purposes of this analysis. DS was defined as an induced state of depressed consciousness accompanied by partial loss of protective reflexes, including the inability to continually maintain an airway independently and/or to respond purposefully to physical stimulation or verbal command, and is produced by a pharmacologic or nonpharmacologic method or a combination thereof. GA was defined as an induced state of unconsciousness accompanied by partial or complete loss of protective reflexes, including the inability to continually maintain an airway independently and respond purposefully to physical stimulation or verbal command, and is produced by a pharmacologic or nonpharmacologic method or combination thereof.[15]

Data Collection–Outcomes Sciences, Inc (Boston, MA) developed an online data entry system and monitored data collection and management. Data were collected and submitted via the Internet by the surgeon or designated member of the office staff using a handheld wireless personal digital assistant device or directly online. The vendor provided onsite education and training to all site participants and developed a Participants Instruction Manual for the site participants to use as a reference.

All information collected for the study, including the consent form, became part of the patient's permanent medical record. Study information was kept in a secure location accessible only to members of the office staff with administrative responsibilities related to the AAOMS office-anesthesia study. To ensure patient and surgeon anonymity, data entered in the national data repository did not contain patient or surgeon names or social security number. Instead, patient and surgeon data were tracked using unique identification numbers assigned by the database system. The anonymity of surgeons and patients was maintained in the database and during analyses.

Data collected on the day of anesthesia included demographic variables, anesthetic risk, operative procedure, anesthetic technique, staffing, and perioperative adverse events. A comprehensive list of data elements is given in Tables 1 through 6. Patient-oriented outcome data were collected either immediately after surgery, during a follow-up visit, or by telephone. If the patient was a minor or could not complete the form without parental input, the parent or guardian was asked to complete the form.

DATABASE MANAGEMENT/ANALYSES

The 3 major types of data entry errors addressed in this study were 1) missing data; 2) incorrect data; and 3) excess variability. Onsite education along with use of the participant manual alone contributed to a re-

Table 1. PATIENT CHARACTERISTICS GROUPED BY ANESTHETIC TECHNIQUE

Study Variable	Overall	Local Anesthesia	Conscious Sedation	General Anesthesia or Deep Sedation	*P*
Sample size	34,391 (100)	4,333 (12.6)	5,321 (15.5)	24,737 (71.9)	NA
Gender					
Male	15,002 (43.6)	2,135 (49.3)	2,248 (42.2)	10,619 (42.9)	
Missing data	169 (0.5)	38 (0.9)	24 (0.5)	107 (0.4)	<.001*
Age (mean ± SD yr)	32.0 ± 19.0	50.9 ± 20.2	35.2 ± 20.7	28.0 ± 16.1	
Missing data	407 (1.2)	169 (3.9)	23 (0.4)	215 (0.9)	<.001†
ASA Class					
I	24,843 (72.2)	2,255 (52.0)	3,825 (71.9)	18,763 (75.8)	
II	8,422 (24.5)	1,682 (38.8)	1,325 (24.9)	5,415 (21.9)	
III	1,083 (3.1)	385 (8.9)	167 (3.1)	531 (2.1)	
IV and V	37 (0.1)	8 (0.2)	4 (0.1)	25 (0.1)	
Missing data	6 (<0.1)	3 (0.1)	0 (<0.1)	3 (<0.1)	<.001
Preoperative anxiety					
Not anxious	6,142 (17.9)	1,153 (26.6)	1,144 (21.5)	3,845 (15.5)	
Somewhat anxious	15,465 (45.0)	2,040 (47.1)	2,535 (47.6)	10,890 (44.0)	
Moderately anxious	8,723 (25.4)	730 (16.8)	1,129 (21.2)	6,864 (27.7)	
Extremely anxious	2,957 (8.6)	182 (4.2)	405 (7.6)	2,370 (9.6)	
Panic-stricken	431 (1.3)	12 (0.3)	34 (0.6)	385 (1.6)	
Missing data	673 (2.0)	216 (5.0)	74 (1.4)	383 (1.5)	<.001
Intraoral procedure‡					
Third molar	20,272 (58.9)	767 (17.7)	2,613 (49.1)	16,892 (68.3)	<.001
Other dentoalveolar	12,965 (37.7)	3,007 (69.4)	2,306 (43.3)	7,652 (30.9)	<.001
Implant	1,159 (3.4)	236 (5.4)	273 (5.1)	650 (2.6)	<.001
Trauma	147 (0.4)	10 (0.2)	26 (0.5)	111 (0.4)	<.001
Pathology	1,202 (3.5)	311 (7.2)	203 (3.8)	688 (2.8)	.36§
Orthognathic	58 (0.2)	4 (0.1)	8 (0.2)	46 (0.2)	.005
Cosmetic	34 (0.1)	2 (<0.1)	0 (0.0)	32 (0.1)	<.001§
Reconstructive	297 (0.9)	18 (0.4)	62 (1.2)	217 (0.9)	.04
Diagnostic block	4 (<0.1)	2 (<0.1)	1 (<0.1)	1 (<0.1)	<.001
Other	1,140 (3.3)	91 (2.1)	390 (7.3)	659 (2.7)	
Extraoral procedure	159 (0.5)	19 (0.4)	34 (0.6)	106 (0.4)	.12

NOTE. Unless otherwise indicated, values are given as number (percent).

*χ^2 statistic.

†One-way analysis of variance.

‡Numbers may exceed 100% because multiple procedures may be completed at one patient visit.

§Exact test.

duction in the frequency of these errors. In addition, incorporated within the software were line edit checks that prompted users to edit their entries for not only missing data but also for values that were illogical or out of range.

To minimize selection bias and ensure that the sites entered consecutively all appropriate patient records in the database, an audit form was developed and sent to all participating sites. The audit was designed to validate data in the database against the source. In conducting the audit, personnel at each site were asked to send source data, from which the initial form was completed. The records used for the audit were to be original sources for the data collected (ie, chart records) rather than paper versions of the online data entry form. The audit data submitted were redacted medical record excerpts for selected patients. An account was created in the online data entry system for the entry of all audit data. The identifications of the patients were concealed, and patient numbers were used as identification. The patient numbers on the audit records were matched to the system-generated number of the original records to enable field-for-field analysis of each record. An audit report was written providing the percentages of matching data items.

Of the 79 surgeons who were sent a database audit verification form, 47 surgeons (60%) signed and confirmed that anesthesia cases were entered consecutively in the online database. We conducted a second, more detailed audit of the 79 surgeons who returned the database verification forms. The second audit included 6 sites selected from each of the 6 AAOMS districts. Patient records (n = 30) were retrieved from each of the 6 sites. The audit consisted of a direct comparison of the patient data entered online with a copy of the patient record. For demographic variables, the percent agreement between the source data (ie, patient record and data entered online) av-

Table 2. MEDICATIONS GROUPED BY ANESTHETIC TECHNIQUE

Study Variable	Overall	Local Anesthesia	Conscious Sedation	General Anesthesia or Deep Sedation	*P*
Sample size	34,391 (100)	4,333 (12.6)	5,321 (15.5)	24,737 (71.9)	NA
Medications					
Premedication was used	8,952 (26.0)	79 (1.8)	1,306 (24.5)	7,567 (30.6)	<.001
Supplemental oxygen was given	28,491 (82.8)	370 (8.5)	4,574 (86.0)	23,547 (95.2)	<.001
Epinephrine was used during procedure	21,160 (61.5)	2,469 (57.0)	3,074 (57.8)	15,617 (63.1)	<.001
Anesthetics used					
Local					
Mepivacaine	5,702 (16.6)	810 (18.7)	832 (15.6)	4,060 (16.4)	<.001
Duranest	1,481 (4.3)	30 (0.7)	133 (2.5)	1,318 (5.3)	<.001
Lidocaine	27,777 (80.8)	3,422 (79.0)	4,340 (80.9)	20,015 (80.9)	.003
Bupivacaine	11,787 (34.3)	427 (9.9)	2,075 (39.0)	9,285 (37.5)	<.001
Articaine	1,267 (3.7)	55 (1.3)	181 (3.4)	1,031 (4.2)	<.001
Other	652 (1.9)	119 (2.7)	88 (1.7)	445 (1.8)	<.001
None	193 (0.6)	NA	77 (1.4)	116 (0.5)	<.001
Missing data	106 (0.3)	106 (2.4)	0 (0)	0 (0)	
Narcotic*†					
Fentanyl	19,042 (63.4)		2,900 (54.5)	16,142 (65.3)	<.001
Meperidine	4,642 (15.4)		897 (16.9)	3,745 (15.1)	.002
Other	1456 (4.8)		39 (0.8)	1417 (5.8)	.004
None	4,996 (16.6)		1,495 (28.1)	3,501 (14.2)	<.001
Benzodiazapine*†					
Diazepam	6,086 (20.2)		798 (15.0)	5,288 (21.4)	<.001
Midazolam	19,529 (65.0)		3,073 (57.8)	16,456 (66.5)	<.001
Other	25 (0.1)		6 (0.1)	19 (0.1)	.573
None	5,125 (17.1)		1,506 (28.3)	3,619 (14.6)	<.001
Other parenteral agent*†					
Ketamine HCl	5,515 (18.3)		231 (4.3)	5,284 (21.4)	<.001
Methohexital	18,317 (60.9)		1,231 (23.1)	17,086 (69.1)	<.001
Propofol	4,988 (16.6)		220 (4.1)	4,768 (19.3)	<.001
Other	1,656 (5.5)		204 (3.8)	1,452 (5.9)	<.001
None	5,184 (17.2)		3,632 (68.3)	1,552 (6.3)	<.001
Vapor used*†					
Nitrous oxide	11,246 (37.4)		2,378 (44.7)	8,868 (35.8)	
Desflurane	11 (0.03)		0 (0.0)	11 (0.04)	
Halothane	102 (0.3)		1 (.02)	99 (0.4)	
Isoflurane	412 (1.2)		0 (0.0)	412 (1.7)	
Sevoflurane	626 (1.8)		70 (1.3)	556 (2.2)	
Other‡	8 (0.02)		2 (0.04)	6 (0.02)	
None	18,727 (62.3)		2,940 (55.3)	15,787 (63.8)	.001
Other medications*					
Flumazenil	237 (0.7)	0 (0.0)	7 (0.1)	230 (0.9)	<.001
Naloxone	1,071 (3.1)	0 (0.0)	13 (0.2)	1,058 (4.3)	<.001
Atropine	3,361 (9.8)	1 (<0.1)	116 (2.2)	3,244 (13.1)	<.001
Dexamethasone	16,498 (48.0)	3 (0.1)	2,493 (46.9)	14,002 (56.6)	<.001
Glycopyrrolate	6,095 (17.7)	9 (0.2)	257 (4.8)	5,829 (23.6)	<.001
Intravenous antibiotics	758 (2.2)	4 (0.1)	282 (5.3)	472 (1.9)	<.001
Paralytic agent	56 (0.2)	0 (0.0)	0 (0.0)	56 (0.2)	<.001
Other	4,098 (11.9)	42 (1.0)	707 (13.3)	3,349 (13.5)	<.001
No "other medications"	14,173 (41.2)	4,276 (98.7)	2,316 (43.5)	7,581 (30.6)	<.001
Total number of medications used during procedure	5.1 ± 2.4	1.1 ± 0.5	4.4 ± 1.8	5.9 ± 1.9	<.001

NOTE. Values given as number (percent).

*Percentages may add up to greater than 100% because multiple medications were used.

†Cases of local anesthetic alone were excluded from these analyses. The sample size for these variables is 30,058.

‡Other vapors include (in frequency of reported use) servoflurane, isoflurane, halothane, and desflurane.

Table 3. INTRAVENOUS ACCESS, FLUIDS, AND MONITORING METHODS GROUPED BY ANESTHETIC TECHNIQUE*

Study Variable	Overall	Local Anesthesia	Conscious Sedation	General Anesthesia or Deep Sedation	*P*
Sample size	34,391 (100)	4,333 (12.6)	5,321 (15.5)	24,737 (71.9)	NA
Intravenous access device					
No intravenous access used	5,788 (16.8)	4,288 (99.0)	1,309 (24.6)	191 (0.8)	
Straight needle	1,788 (5.2)	3 (0.1)	185 (3.5)	1,600 (6.5)	
Butterfly	11,994 (34.9)	169 (3.4)	1,207 (26.0)	10,618 (42.9)	
Angiocath	14,783 (43.0)	18 (0.4)	2,452 (46.1)	12,313 (49.8)	
Intravenous device unspecified	38 (0.1)	5 (0.1)	18 (0.3)	15 (0.1)	<.001
Intravenous fluids					
None used	15,721 (45.7)	4,311 (99.5)	2,202 (41.4)	9,208 (37.2)	
Intravenous fluids without continuous flow	1,948 (5.7)	1 (<0.1)	17 (0.3)	1,930 (7.8)	
Intravenous fluids uses with continuous flow	16,722 (48.6)	21 (0.5)	3,102 (58.3)	13,599 (55.0)	<.001
Monitoring methods*					
Blood pressure	33,093 (96.2)	3,353 (77.4)	5,174 (97.2)	24,566 (99.3)	<.001
Pulse oximetry	30,126 (87.6)	582 (13.4)	4,909 (92.3)	24,635 (99.6)	<.001
Electrocardiogram	29,014 (84.4)	350 (8.1)	4,473 (84.1)	24,191 (97.8)	<.001
Precordial stethoscope	6,420 (18.7)	5 (0.1)	400 (7.5)	6,015 (24.3)	<.001
Pretracheal stethoscope	5,021 (14.6)	25 (0.6)	732 (13.8)	4,264 (17.2)	<.001
Visual monitoring of chest movement	25,049 (72.8)	359 (8.3)	3,360 (63.1)	21,330 (86.2)	<.001
Capnography	4,955 (14.4)	9 (0.2)	489 (9.2)	4,457 (18.0)	<.001
Electroencephalogram	625 (1.8)	3 (0.1)	4 (0.1)	618 (2.5)	<.001
Preoperative temperature	6,820 (19.8)	400 (9.2)	467 (8.8)	5,953 (24.1)	<.001
Postoperative temperature	1,810 (5.3)	38 (0.9)	309 (5.8)	1,463 (5.9)	<.001
Continuous temperature	1,116 (3.2)	1 (<0.1)	74 (1.4)	1,041 (4.2)	<.001
Anesthesia time (min)					
<10	2,797 (8.1)	1,094 (25.2)	250 (4.7)	1,453 (5.9)	
10–30	19,143 (55.7)	2,089 (48.2)	2,432 (45.7)	14,622 (59.1)	
31–60	10,135 (29.5)	266 (6.1)	2,281 (42.9)	7,588 (30.7)	
61–120	1,162 (3.4)	13 (0.3)	239 (4.5)	910 (3.7)	<.001
>120	92 (0.3)	1 (<0.1)	19 (0.4)	72 (0.3)	
Missing data	1,062 (3.1)	870 (20.1)	100 (1.9)	92 (0.4)	

NOTE. Values given as number (percentage).

*Total percentages exceed 100% because multiple monitoring methods are used per patient.

eraged 70% and ranged from 25% (date of birth) to 95% (ASA status). For procedure variables, the agreement percentage between the source data and database averaged 99.3% and ranged between 95% and 100%. For anesthetic technique variables, the average percent agreement was 86% and ranged from 70% (deepest anesthetic level and total anesthesia time) to 100% (intubation status). For anesthesia staffing, the percent agreement averaged 95% and ranged from 80% (background of primary recovery personnel) to 95% (all other variables). For complications, the percent agreement averaged 95% and ranged from 86% (outcome of complication) to 100% (all other variables). Percent agreement could not be computed for the patient satisfaction variables. For studies of this magnitude, the acceptable level of error, set a priori, was less than 10%. All categories verified by audit met these criteria.

For study data, descriptive data were computed for each study variable. Bivariate analyses were used to assess relationships between the predictor and outcome variables. Statistical significance was set at $P \leq .05$. Data analyses were conducted using SPSS, Inc Version 10.0 (SPSS, Chicago, IL).

Results

Between January 2001 and December 2001 inclusive, 79 volunteer OMSs located at 58 study sites enrolled 34,578 patients in the study. Approximately 0.5% cases (187) were excluded from analyses because the anesthetic technique was not reported. The sample size available for analyses was 34,391.

Table 1 summarizes the patient characteristics of the sample grouped by anesthetic technique. Data collection for patients undergoing procedures with

Table 4. STAFFING GROUPED BY ANESTHETIC TECHNIQUE

Study Variable	Overall	Local Anesthesia	Conscious Sedation	General Anesthesia or Deep Sedation	*P*
Sample size	34,391 (100)	4,333 (12.6)	5,321 (15.5)	24,737 (71.9)	NA
Personnel					
Primary manager of anesthesia					
Operating surgeon	32,832 (95.5)	3,961 (91.4)	5,295 (99.5)	23,576 (95.5)	<.001
Assisting/other surgeon	10 (<0.1)	0 (0.0)	1 (<0.1)	9 (<0.1)	1.000
MD anesthesiologist	496 (1.4)	0 (0.0)	5 (0.1)	491 (2.0)	<.001
Dentist anesthesiologist	2 (<0.1)	0 (0.0)	1 (<0.1)	1 (<0.1)	.5
CRN anesthesiologist	655 (1.9)	0 (0.0)	1 (<0.1)	654 (2.6)	<.001
Other	8 (<0.1)	3 (0.1)	2 (<0.1)	3 (<0.1)	.04
Missing data	388 (1.1)	369 (8.5)	16 (0.3)	3 (<0.1)	
Mean size of surgical team	2.7 ± 0.6	2.2 ± 0.4	2.5 ± 0.5	2.8 ± 0.6	
Missing data	472 (1.4)	401 (9.3)	27 (0.5)	44 (0.2)	<.001
Mean size of anesthesia team	2.5 ± 0.8	1.6 ± 0.8	2.3 ± 0.6	2.7 ± 0.7	<.001
Missing data	381 (1.1)	374 (7.5)	5 (0.1)	2 (<0.1)	
Recovery personnel (primary person only)					
OMFS	1,783 (5.2)	290 (6.7)	811 (15.2)	682 (2.8)	<.001
Assisting surgeon	4 (<0.1)	0 (0.0)	2 (<0.1)	2 (<0.1)	.193
Other surgeon	1 (<0.1)	0 (0.0)	0 (0.0)	1 (<0.1)	1.000
MD anesthesiologist	59 (0.2)	0 (0.0)	0 (0.0)	59 (0.2)	<.001
Dentist anesthetist	10 (<0.1)	1 (<0.1)	1 (<0.1)	8 (<0.1)	1.000
CRN anesthesiologist	624 (1.8)	1 (<0.1)	1 (<0.1)	622 (2.5)	<.001
RN/LPN	6,783 (19.7)	370 (8.5)	742 (13.9)	5,671 (22.9)	<.001
OMAAP-trained assistant	10,720 (31.2)	1,081 (24.9)	1,274 (23.9)	8,365 (33.8)	<.001
Other certified assistant	6,164 (17.9)	437 (10.1)	1,191 (22.4)	4,536 (18.3)	<.001
Other recovery personnel	6,108 (17.8)	525 (12.1)	905 (17.0)	4,678 (18.9)	<.000
No one specifically assigned	1,628 (4.7)	1,628 (37.6)	0 (0)	0 (0)	NA
Missing data	507 (1.5) (6.2)		394 (7.4)	113 (0.5)	

NOTE. Unless otherwise specified, values given as number (percent).

Abbreviations: MD, doctor of medicine; CRN, certified registered nurse; OMFS, oral and maxillofacial surgeon; RN, registered nurse; LPN, licensed practical nurse; OMAAP, Oral and Maxillofacial Anesthesia Assistants Program.

local anesthetic alone was terminated after 3 months due to a rapid enrollment. Also, because the primary goal of this project was to assess outcomes associated with conscious sedation and DS/GA, it seemed prudent to limit the sample size of patients receiving local anesthesia alone. In this sample, 71.9% of patients received DS/GA. Similar percentages of patients chose local anesthesia (12.6%) or conscious sedation (15.5%). Overall, 43.6% of the sample was male. The distribution of gender was statistically significantly different among the 3 anesthesia techniques ($P < .001$). The mean age of the sample was 32.0 ± 19.0 (SD) years and ranged from 50.9 ± 20.2 years for patients receiving local anesthesia to 28.0 ± 16.1 years for patients receiving DS/GA ($P < .001$). In terms of anesthetic risk, 96.7% of patients were ranked as ASA of II or less. Patients undergoing procedures using local anesthetic alone were 2.7 to 4 times more likely to have an ASA score of greater than II than were patients undergoing conscious sedation or DS/GA, respectively ($P < .001$). Most patients (80.3%) reported some degree of anxiety associated with the scheduled procedure. Patients differed significantly on level of anxiety when grouped by anesthetic technique ($P < .001$). Patients receiving local anesthesia were more likely to report not being anxious compared with patients having conscious sedation ($P < .001$), and patients with conscious sedation were more likely to report not being anxious than patients having deep DS/GA ($P < .001$). Third molar removal and other dentoalveolar procedures composed the majority (>95%) of procedures in this study.

Table 2 summarizes medications used grouped by anesthetic technique. Supplemental oxygen use was reported in 86% and 95.2% of patients receiving conscious sedation or DS/GA, respectively. The most frequently used local anesthetic agents were lidocaine (80.8%) and bupivacaine (34.3%). The totals frequently add to greater than 100%, because one patient can receive multiple medications. In the setting of conscious sedation and DS/GA, fentanyl and meperidine accounted for the majority of narcotics used. Diazepam and midazolam were the most frequently

Table 5. COMPLICATIONS GROUPED BY ANESTHETIC TECHNIQUE

Study Variable	Overall	Local Anesthesia	Conscious Sedation	General Anesthesia or Deep Sedation	P
Sample size	34,391 (100)	4,333 (12.6)	5,321 (15.5)	24,737 (71.9)	NA
No complication reported	33,946 (98.7)	4,316 (99.6)	5,273 (99.1)	24,357 (98.5)	<.001
Types of complication*					
Vomiting—induction	45 (0.1)	0 (0.0)	9 (0.2)	36 (0.1)	.035
Vomiting—recovery room	112 (0.3)	2 (<0.1)	17 (0.3)	93 (0.4)	.002
Laryngospasm/bronchospasm	77 (0.2)	0 (0.0)	1 (<0.1)	76 (0.3)	<.001
Respiratory	23 (0.1)	0 (0.0)	0 (0.0)	23 (0.1)	.006
Cardiac arrhythmia	18 (0.1)	1 (<0.1)	1 (<0.1)	16 (0.1)	.404
Syncope	45 (0.1)	12 (0.3)	7 (0.1)	26 (0.1)	.016
Seizure	4 (<0.1)	1 (<0.1)	0 (0.0)	3 (<0.1)	.502
Neurologic impairment	1 (<0.1)	1 (<0.1)	0 (0.0)	0 (0.0)	.13
Prolonged recovery	56 (0.2)	0 (0.0)	10 (0.2)	46 (0.2)	.018
Peripheral vascular	58 (0.2)	1 (<0.1)	1 (<0.1)	56 (0.2)	<.001
Other complications	36 (0.1)	3 (0.1)	4 (0.1)	29 (0.1)	.64
Hospitalizations due to anesthetic complications	2 (<0.1)	0 (0.0)	0 (0.0)	2 (<0.1)†	1.00

NOTE. Values given as number (percent).

*Percentages exceed 100% because multiple complications may occur per patient.

†There was 0.81 hospitalization per 10,000 general anesthesia or deep sedation procedures.

used benzodiazepine agents. In the setting of conscious sedation, practitioners were 50% less likely to use a narcotic or benzodiazepine than in the setting of DS/GA ($P < .001$). Other commonly used parenteral agents were ketamine, methohexital, or propofol. Vapor anesthetics, including nitrous oxide, were used in approximately 50% of conscious sedation and DS/GA cases. Nitrous oxide was used more frequently ($P < .001$) in conscious sedation cases (44.7%) than DS/GA cases (35.8%). Other vapor anesthetic agents (Table 2), however, were used more frequently ($P < .001$) in DS/GA (12.2%) than in conscious sedation cases (3.1%). Table 2 also lists a variety of other agents used variably during these procedures, of which dexamethasone was reported most frequently (48%). On average, there were 5.1 $\pm$ 2.4 different medications used per case.

Table 3 summarizes intravenous (IV) access methods, types of IV fluids, monitoring methods, and anesthesia time categorized by anesthetic technique. IV access was used in 75.6% and 99.2% of conscious sedation and DS/GA cases, respectively. A butterfly needle or angiocatheter was used most frequently (>93.5%) to obtain and maintain access. IV fluids were used in 58.6% and 62.8% of the cases in which patients received conscious sedation and DS/GA, respectively.

Perioperative monitoring methods used are outlined in detail in Table 3. There were statistically significant differences in the methods used among the 3 techniques ($P < .001$). Regardless of anesthetic technique, blood pressure was frequently monitored, ie, greater than 77.4%. Other vital signs were uncommonly monitored (<13.4%) when local anesthetic alone was used. Multiple modality monitoring was frequently used in the settings of conscious sedation and DS/GA, including blood pressure, pulse oximetry, electrocardiogram, stethoscopes, capnography, preoperative temperature assessment, and physical examination (eg, assessing chest movements).

The intensity of the monitoring increased with the complexity of the anesthetic technique. Brain level activity using bispectral analyses (BIS Monitor; Aspect Medical Systems Newton, MA) and intraoperative and postoperative temperature monitoring was uncommonly reported (<5.9%). Although the range of anesthetic times varies from less than 10 minutes to greater than 120 minutes, the overwhelming majority of cases were less than 60 minutes (93%).

Table 4 summarizes staffing of cases grouped by anesthetic technique. The anesthesia team was defined as those individual(s) whose responsibility was in the administration of the anesthetic agent. The surgical team was defined as those individual(s) whose responsibility was in the performing the operation, assisting, or circulating. Only the surgeon could be a member of one or both teams. In the most cases, the operating surgeon is the primary manager of the anesthetic (>91.4%). After excluding missing data from the calculations, the percentage increased to greater than 95.5%. Overall, the mean size of the surgical and anesthesia teams were 2.7 $\pm$ 0.6 and 2.5 $\pm$ 0.8, respectively. As the intensity of the anesthetic increased, the mean size of both the surgical and anesthetic teams increased significantly ($P < .001$). The primary person responsible for patient

Table 6. PATIENT SATISFACTION GROUPED BY ANESTHETIC TECHNIQUE

Study Variable	Overall	Local Anesthesia	Conscious Sedation	General Anesthesia or Deep Sedation	*P*
Sample size	20,455 (100)	2,995 (14.6)	2,548 (12.5)	14,912 (72.9)	NA
Memory after anesthesia					
Pain	695 (3.4)	282 (9.4)	133 (5.2)	280 (1.9)	<.001
Discharge instructions	7,116 (34.8)	1,866 (62.3)	1,197 (47.0)	4,053 (27.2)	<.001
Neither pain nor instructions	12,914 (63.1)	968 (32.3)	1,276 (50.1)	10,670 (71.6)	<.001
Memory of operation					
Awake, able to communicate	1,899 (9.3)	601 (20.1)	666 (26.1)	632 (4.2)	
Awake, unable to communicate	718 (3.5)	20 (0.7)	153 (6.0)	545 (3.7)	
Remember nothing	14,855 (72.6)	77 (2.6)	1,278 (50.2)	13,500 (90.5)	<.001
Missing data	2,983 (14.6)	297 (76.7)	451 (17.7)	235 (1.6)	
Satisfaction with anesthetic					
Extremely satisfied	16,785 (82.1)	2,266 (75.7)	1,991 (78.1)	12,528 (84.0)	
Moderately satisfied	2,504 (12.2)	467 (15.6)	415 (16.3)	1,622 (10.9)	
Neutral	689 (3.4)	136 (4.5)	88 (3.5)	465 (3.1)	
Moderately dissatisfied	148 (0.7)	27 (0.9)	19 (0.7)	102 (0.7)	
Extremely dissatisfied	68 (0.3)	9 (0.3)	6 (0.2)	53 (0.4)	
Missing data	261 (1.3)	90 (3.0)	29 (1.1)	142 (1.0)	<.001
Recommend to a loved one					
No	154 (0.8)	52 (1.7)	18 (0.7)	84 (0.6)	
Not sure	678 (3.3)	156 (5.2)	111 (4.4)	411 (2.8)	
Yes	19,375 (94.7)	2,695 (90.0)	2,401 (94.2)	14,279 (95.8)	
Missing data	248 (1.2)	92 (3.1)	18 (0.7)	138 (0.9)	<.001
Anxious about future experiences					
Not anxious	12,521 (61.2)	1,736 (58.0)	1,634 (64.1)	9,151 (61.4)	
Somewhat anxious	4,320 (21.1)	646 (21.6)	498 (19.5)	3,176 (21.3)	
Moderately anxious	2,023 (9.9)	320 (10.7)	254 (10.0)	1,449 (9.7)	
Extremely anxious	1,251 (6.1)	175 (5.8)	135 (5.3)	941 (6.3)	
Panic stricken	98 (0.5)	21 (0.7)	10 (0.4)	67 (0.4)	.007
Missing data	242 (1.2)	97 (3.2)	17 (0.7)	128 (0.9)	

NOTE. Values are given as number (percent).

recovery regardless of techniques was a registered nurse or licensed practical nurse, Oral and Maxillofacial Anesthesia Assistants Program (OMAAP)-trained assistant, other certified assistant, or other recovery personnel for 87.1% of the cases. The operating surgeon uncommonly was the primary recovery person (5.2%). Interestingly, in the setting of conscious sedation (15.2%), the operating surgeon was 2 to 3 times more likely to be the primary recovery person compared with the setting of local anesthesia alone (6.7%) or DS/GA (2.8%) ($P < .001$).

Table 5 enumerates the types and frequencies of complications associated with office-based ambulatory anesthesia. The overall complication rate per patient was 1.3 per 100 cases. The lowest complication rate (0.4%) was associated with using local anesthesia alone, and the highest was with DS/GA (1.5%) with conscious sedation occupying an intermediate rate (0.9%) ($P < .001$). The types of complications included gastrointestinal (ie, vomiting at the time of induction or in the recovery area, 0.1% and 0.3% respectively), laryngospasm, bronchospasm, or other associated respiratory complications (0.3%), cardiac arrhythmia (0.1%), syncope (0.1%), seizure (<0.1%), neurologic impairment (<0.1%), prolonged recovery (0.2%), peripheral vascular injuries or complications (0.2%), and other complications (0.1%).

Two patients, who both received DS/GA, experienced complications requiring hospitalization. The risk for hospitalization was 8.1 per 100,000 DS/GA procedures. In this sample, the overall risk for hospitalization, regardless of anesthetic technique, was 5.8 per 100,000 procedures. One patient was hospitalized overnight to treat an allergic reaction following the administration of cefazolin. The second patient aspirated and was hospitalized for the management of aspiration pneumonitis, leukopenia, and pneumonia.

Table 6 summarizes patient satisfaction grouped by anesthetic technique. Regardless of technique, 94.3% of the patients reported satisfaction with the anesthetic. As the intensity of the technique increased from local anesthesia to conscious sedation or DS/GA, the degree of satisfaction increased from 91.3% to almost 95% ($P < .001$). More than 94.7% of all patients would recommend the anesthetic technique to a loved one (range, 90% for local anesthetic to 95.8% for DS/GA) ($P < .001$). Some amnesia in association with the operation is a desired outcome for patients undergoing conscious sedation or DS/GA. To assess amnesia, we used a variable called "memory of operation." In response to the questionnaire, 90.5% of patients undergoing DS/GA and 50.2% of patients undergoing conscious sedation reported no memory of the operation ($P < .001$). Absence of operative pain is also a desirable outcome. Overall, 96.6% of the sample reported no memory of intraoperative pain. The reported frequencies of memory of pain after anesthesia were 9.4%, 5.2%, and 1.9% for local anesthetic, conscious sedation, and DS/GA, respectively ($P < .001$). Remembering postoperative instructions is a desirable outcome. Overall, 34.8% of patients reported recall of the postoperative instructions. The frequency of recall of postoperative instructions decreased with increasing intensity of anesthetic technique from 62.3% for patient receiving local anesthetic alone to 27.2% for patient undergoing DS/GA ($P < .001$). When queried before the procedure, 17.9% of all patients reported no anxiety about their upcoming operation. After the procedure, 61.2% of all patients reported having no anxiety about future operations and their associated anesthetic technique ($P < .001$).

Discussion

The overarching goal of the Oral and Maxillofacial Outcomes System was to establish a specialty-specific data repository for tracking national practice trends, estimating risk-adjusted outcomes of care, and determining associations between alternative processes of care and outcomes. One service of interest, the delivery of office-based ambulatory anesthesia services, is an integral component of the OMSs' daily practice. To address deficiencies in the current literature, the purpose of this report was to provide an overview of current OMS anesthesia practice in the office-based ambulatory setting. The study results were based on the largest prospective patient sample ever enrolled evaluating office-based practices. The results show that the office-based administration of local anesthesia, conscious sedation, or DS/GA delivered by OMSs was safe and associated with a high level of patient satisfaction. No deaths were reported in the sample. The overall complication rate was found to be 1.3%, with none having long-term adverse consequences. In addition, the level of patient satisfaction was extremely high, with almost 95% of patients recommending the anesthetic technique to another loved one.

DEMOGRAPHICS

As expected, patients receiving local anesthesia were statistically older than those receiving either conscious sedation or DS/GA. Gender was also statistically associated with the anesthesia technique, with men more likely to choose local anesthesia than women. Likewise, more patients with ASA III, IV, and V classifications received local anesthesia. Not surprisingly, the preanesthesia anxiety level was statistically associated with the anesthesia techniques used. Patients receiving DS/GA were more anxious than those receiving local anesthesia. Office-based anesthesia is ideally suited for short procedures. In this study, the length of the procedure was less than 30 minutes in over two thirds of the cases.

The proportion of patients receiving conscious sedation or DS/GA (87%) in this study should not be extrapolated to the general population. The proportion of patients receiving local anesthesia alone was underrepresented as a function of the methods. Data collection for patients receiving local anesthesia alone ($n = 4,333$) was limited to the first 3 months of the study. Continuing to collect local anesthesia data would have been an added burden for the voluntary, unpaid participants. When extrapolated to 12 months, the proportion of local anesthesia services provided would have accounted for 17,332 (37%) of all anesthetics administered in the office-based setting, whereas conscious sedation was 5,321 (11%) and DS/GA was 24,737 (52%). The use of local anesthetic use may even be more underestimated than our results show because several participants joined the study after the local anesthesia data collection had been completed.

MEDICATIONS

Premedication was defined as sedative or hypnotic medications given to the patients before the surgical procedure. Therefore, a patient may have been provided oral or parenteral premedications before beginning the anesthetic for the procedure. Overall, 26% of the patients received some type of premedication. To the authors, the estimate of premedication use appeared higher than expected, but we attribute this to the broad definition of premedication used in this study. Paralleling the use of the premedication was the patient's documentation of the preoperative anxiety level with more than 35% of patients reporting their preoperative anxiety level to be moderately to severely anxious to panic stricken.

Most OMSs administered newer types of narcotics and benzodiazepines for conscious sedation and DS/

GA. Methohexital remained the intravenous anesthetic agent of choice, but propofol was used almost 17% of the time. We believe that the proportion of OMSs using propofol will increase as more surgeons become familiar with its use in the office-based setting. Other than oxygen and nitrous oxide, inhalational agents were seldom used.

INTRAVENOUS ACCESS, FLUID MANAGEMENT, AND MONITORING METHODS

To our knowledge, this study is the first report to summarize patterns of IV access in the office-based ambulatory setting. For most patients, IV access was established using a butterfly needle or angiocatheter, and the majority had continuous flow of IV fluids. The vast majority (>98%) of sites monitored blood pressure, oxygen saturation, and cardiac performance.

With respect to ventilatory monitoring, the majority of sites used visual assessment of chest movements. Overall, 50.7% of patients were monitored with just 1 technique, 36.2% were monitored with 2 techniques, 7.3% were monitored with 3 techniques, and just 0.1% (13) were monitored with all 4 techniques when receiving DS/GA. Capnography was used by itself 1.5% of the time, and visual monitoring was used by itself 49.2% of the time. Precordial stethoscope was used by itself 18.3% of the time, and pretracheal stethoscope, 20.7%. However, 95.4% of all patients were monitored using at least one of the following methods: chest movements, precordial stethoscope, pretracheal stethoscope, and capnography. Controversy exists regarding the use of capnography in the nonintubated patients. We hypothesize that as the capnography technology improves, it will be more broadly accepted and used.

In the operating room, bispectral analysis (BIS) is commonly used to monitor brain activity as a marker of depth of anesthesia. BIS use in the office-based ambulatory setting has never been documented. In this study, 2.5% of patients receiving DS/GA had their depth of anesthesia monitored via BIS. The use of BIS analyses may grow as surgeons become more educated about its benefits.[16,17]

STAFFING

The issue of a surgeon simultaneously providing operative and anesthetic services, a core competency of OMSs for nearly a century, remains controversial. In this study, the operating surgeon provided anesthesia services 96% of the time and was supported by 2 to 3 personnel. This finding validates that OMSs comply with the guidelines of the AAOMS *Parameters of Care and Clinical Pathways* and *Office Anesthesia Evaluation* recommendations and recognize the need for an adequate number of support personnel when the operating surgeon administers anesthesia services.[12,18]

PATIENT SAFETY AND COMPLICATIONS

This study provided the first prospective cohort data on potential adverse outcomes of anesthesia as defined in the AAOMS *Parameters of Care*.[12] As expected, local anesthesia had the lowest incidence of adverse outcomes, followed by conscious sedation. For DS/GA, the types of adverse outcomes recorded were similar to those found in other studies.[2-11] Overall, 98.7% of cases had no adverse outcomes related to anesthesia. The complication rate ranged from 0.4% for local anesthesia to 1.5% for DS/GA. Regardless of anesthetic technique, all but one of the complications was minor and transient. The one patient previously described was hospitalized due to aspirating vomitus and the patient recovered fully. Based on this study, the hospitalization rate for patients receiving DS/GA was 8.1 per 100,000 cases. One patient was admitted due to a surgical complication, that is, allergic reaction to administration of perioperative antibiotics. The second complication was an anesthetic complication: aspiration. Therefore, the estimated anesthetic-specific hospitalization rate was 4 per 100,000. Both complications described were probably not preventable and are known risks of surgery and anesthesia.

No deaths were reported in this study. D'Eramo[2] reported a mortality rate of 1:1 million after the administration of office-based anesthesia by OMSs. Based on data collected by the Oral Maxillofacial Surgery National Insurance Corporation (OMSNIC) between 1988 and 2001, the incidence of death or brain injury was 1.28 per 1 million anesthetics administered.[19] Although this estimate is higher than that of previous studies, the other studies did not include brain injury in the numerator.[1-11] Although it is evident that the true morality rate is not zero, the office-based anesthesia mortality rate provided by OMSs has been decreasing.

PATIENT SATISFACTION

Most patients (>94%) were very satisfied with the anesthetic technique used by the OMS and would recommend it to a loved one. Patient satisfaction increased with the complexity of the anesthetic technique (local anesthesia, 91.3% to 94.9% for DS/GA). A desirable outcome of DS/GA is perioperative amnesia. More than 90% of patients receiving DS/GA had no recall of the operation. Overall, 35% of patients did not recall their discharge instructions. This is not surprising for patients who have received sedation, but almost 33% of patients who received local anesthesia did not remember their discharge instructions. Based on this finding, regardless of the anesthetic technique, patients and their escorts should receive oral and written discharge instructions.

Another desired outcome of office-based anesthesia is reducing patient anxiety. Before the operation, 82%

of the patients had mild to severe anxiety about the planned operation. When queried after the procedure, almost 38% of the patients expressed mild to severe anxiety about future operations. There was almost a 50% reduction in the number of patients who reported mild to severe anxiety after the surgical procedure, reflecting the excellent level of anesthetic services provided by OMSs.

Safety and the quality of care are prime concerns during the administration of anesthesia in an office-based ambulatory setting. The AAOMS has a long history of programs and standards that regulate the anesthesia practice of its members. In 1971, the AAOMS Committee on Anesthesia developed the Office Anesthesia Evaluation Manual. This manual contained standards for conducting an onsite office evaluation program. In addition, a program was designed to assure that members of the specialty maintain properly equipped offices and are prepared to use accepted current techniques for managing emergencies and complications of anesthesia in the outpatient setting. In an age when regulation of anesthesia practice is commonplace, the actions of the specialty in 1971 have served through the years as a model for dentistry and medicine alike. These programs were not mandated by an outside agency. However, the specialty mandates these programs to regulate its members and to ensure the delivery of quality care. The AAOMS enforces onsite office evaluations by linking membership in state societies to compliance with this program.

In 1989, AAOMS implemented the OMAAP. This 6-month training program provides didactic education and clinical experience to enhance the assistant's ability to aid in the delivery of management of office-based sedation and/or GA. Since its inception, more than 8,000 individuals have participated in the program.

In addition to the materials and programs previously described, the AAOMS released version 1.0 of the AAOMS *Parameters of Care for Oral and Maxillofacial Surgery* in 1992.[20] One section of this document established guidelines for the administration of anesthesia in the office-based setting. These anesthesia guidelines for the office-based ambulatory setting were the first developed by any national organization and included such items as risk assessment, perioperative management, anesthetic record documentation, personnel, equipment, and postanesthesia management. Subsequent revisions to this document have been completed on a regular basis and have received concurrence by the American Society of Anesthesiologists as appropriate current outpatient anesthesia practice.[21]

DEVIATIONS FROM SPECIALTY RECOMMENDATIONS

Although this study showed high levels of safety and patient satisfaction, there are some findings that identify opportunities for improvement, especially with respect to compliance to the recommendations put forth in the *Parameters of Care* and *AAOMS Office Anesthesia Evaluation Manual*.[18,20,21]

During the administration of DS/GA, it is recommended that there is continuous use of pulse oximetry, recording of blood pressure every 5 minutes, continuous cardiovascular monitoring with an electrocardioscope, and the use of supplemental oxygen throughout the anesthesia period. Ventilatory monitoring should include auscultation of breath sounds and include at least one of the following: 1) observations of chest wall; 2) observation of reservoir bag; 3) monitoring color of skin, nail, mucosa, and surgical site, or 4) capnography. Additional monitoring should include either auscultation of heart sounds or palpation of peripheral pulses. Although the majority of cases met these recommendations, there was not 100% compliance. Likewise, there was not 100% compliance in the use of capnography for the electively intubated patient.

The exemplary level of safety and positive outcomes during the administration of DS/GA in the office-based setting is in part due to the recommendations set forth in these 2 documents. They are based on standards of care established by the anesthesia community, accreditation agencies, and evidence-based medicine. Reasons for less than 100% compliance identified in this study are unknown. Data entry errors are a possibility along with knowledge deficits of the recommendations found in these 2 documents. This supports the need to address these recommendations in anesthesia continuing education programs and the implement mandatory inspections of all sites providing DS/GA. It is also essential that every person administering DS/GA in the office-based setting review these documents and comply with these and other recommendations.

This study of office-based ambulatory anesthesia is the largest ever reported. The findings show that office-based ambulatory anesthesia as practiced by OMSs is safe, with all of the anesthetic techniques. More than 95% of the time, the operating surgeon is the anesthetist and performs the operation with a support team of at least 2 or 3 additional individuals and modern monitoring techniques. In addition to outstanding outcomes, patients were very satisfied with the anesthesia provided by OMSs. Adherence to recommended staffing levels, formal anesthesia training of OMSs, use of AAOMS anesthesia guidelines, onsite office evaluations, and the OMAAP all contribute to the low mortality and incidence of adverse outcomes and high levels of patient satisfaction associated with the anesthesia services provided by OMSs in the office-based ambulatory setting.

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Discussion

Office-Based Ambulatory Anesthesia: Outcomes of Clinical Practice of Oral and Maxillofacial Surgeons

Henry C. Windell, DMD

Member, AAOMS Anesthesia Committee; Private Practice, Oral and Maxillofacial Surgery, Gresham, Oregon; e-mail: goms7@easystreet.com

The delivery of anesthesia has been the hallmark of oral and maxillofacial surgery practice for many decades. To provide the type of anesthesia service we do, the profession has made great strides to ensure the safe delivery of anesthesia to our patients by not only providing education, but also publishing articles and establishing programs for improvement in the delivery of anesthesia.

This current article provides the first and most complete prospective study of outpatient anesthesia in the private practice setting. All previous articles have dealt with morbidity and mortality studies on a retrospective basis including relative small numbers of participants. The large number of patients involved and the wealth of data collected serve to provide the profession with a valuable tool to assist us in the future with the concerns and challenges we face in outpatient anesthesia.

Overall I believe the article is well written, accurate, and informational for the practicing oral and maxillofacial sur-