CHAPTER 26

Techniques of intravenous sedation

In this chapter a number of techniques of IV sedation will be discussed. These techniques employ many of the drugs discussed in Chapter 25 and will be grouped into four different levels, based on the degree of difficulty, the degree of training required by the doctor prior to employing the technique, and the requirement for patient monitoring during the procedure. These four categories are (1) basic techniques, (2) modifications of basic techniques, (3) advanced techniques, and (4) other techniques.

On p. 366 are the categories and the techniques to be discussed.

MONITORING INTRAVENOUS SEDATION

Whenever drugs are administered intravenously, it becomes of paramount importance for the patient to be monitored somewhat more closely than following oral or inhalation sedation. The following regimen is suggested:

1. Baseline vital signs are recorded at preliminary appointment
   a. Blood pressure
   b. Heart rate and rhythm
   c. Respiratory rate
2. Vital signs are recorded immediately preoperatively on day of treatment
3. Immediately after IV drug administration, vital signs are taken
4. Every 10 to 15 minutes throughout procedure, vital signs may be taken
5. Postoperatively, vital signs are recorded

In addition, a precordial stethoscope is strongly recommended. A pulse meter is recommended, but not essential. An ECG is recommended for use as indicated (patient with cardiovascular risk), but not essential for the ASA I or II patient.

Verbal contact with the patient is probably the most important means of monitoring during sedative procedures. The patient should always be capable of responding to verbal or physical stimulation.

BASIC INTRAVENOUS TECHNIQUES

The first group of sedation techniques include those that form the backbone of IV sedation. With the availability of these three techniques the doctor will be able to meet the needs of a dental procedure of any duration and achieve satisfactory sedation in virtually all patients requiring the IV route.

The Jorgensen technique is the original IV sedation technique. In spite of attempts over the years at improving it, the original technique is still being taught today and is still providing excellent sedation with few if any significant complications being reported. The primary use for the Jorgensen technique is for procedures requiring 2 or more hours to complete.

The technique employing diazepam has become the most popular method of IV sedation in dentistry. It meets the needs of contemporary dental practice, that is, sedation of approximately 1 hour duration. Within a few years, barring unforeseen circumstances, it is expected that midazolam will challenge diazepam for supremacy in the 1-hour IV sedation area.

With these two techniques virtually all patients requiring IV sedation can be treated successfully. However, with the major effect of diazepam or midazolam being under 1 hour, and the Jorgensen technique effective for more than 2 hours, a procedure that provides effective sedation of from 1 to 2 hours is needed. This need is effectively met by promethazine.

INTRAVENOUS SEDATION TECHNIQUES

Basic techniques

1. Diazepam or midazolam
2. Jorgensen technique
3. Promethazine

Modifications of basic techniques

Diazepam or midazolam with anticholinergic agent

Advanced techniques

1. Diazepam or midazolam with narcotic plus anticholinergic agents
2. Promethazine with narcotic
3. Pentobarbital with narcotic plus anticholinergic agent
4. Narcotic with group A drug

Others

1. Diazepam with methohexital (Foreman technique)
2. Berns technique
3. Shane technique

CLASSIFICATION OF INTRAVENOUS MEDICATIONS

Group A (antianxiety or sedative-hypnotic agents)

1. Diazepam
2. Midazolam
3. Pentobarbital
4. Promethazine

Group B (narcotic-type analgesics)

1. Meperidine
2. Morphine
3. Alphaprodine
4. Fentanyl
5. Pentazocine
6. Nalbuphine
7. Butorphanol

Group C (anticholinergics)

1. Atropine
2. Scopolamine
3. Glycopyrrolate

These three techniques are described below. The techniques of diazepam and Jorgensen will be described in detail. These provide the basic format for the techniques to follow, which will be described in somewhat less detail.

Intravenous diazepam or midazolam

Preliminary appointment

When diazepam or midazolam is being considered for use intravenously, specific questions must be asked of the patient concerning prior experience with the drugs to be used, any adverse responses to them, and about specific contraindications to their use. For diazepam and midazolam these include the following:

1. Allergy or hypersensitivity to benzodiazepines
2. Glaucoma (untreated)
3. History of phlebitis, thrombophlebitis (contraindication to diazepam)
4. Acute pulmonary insufficiency (contraindication to midazolam)
5. Preexisting respiratory depression

Prior to the actual day of treatment, the following items concerning the patient's suitability for IV sedation are evaluated by the doctor and staff.

1. Degree of apprehension. Which technique of sedation (oral, IM, inhalation, IV) is most appropriate for this patient? If the IV route is selected, which of the techniques is most appropriate for this patient?

2. Informed consent. If the IV route is selected, the patient must be given an informed consent form, which describes the procedure, its alternatives (e.g., IM, general anesthesia), and the more likely complications of treatment. The patient is asked to sign the form, which is then added to the patient's dental chart.

3. Medical history. The medical history questionnaire, dialogue history, and vital signs are reviewed to determine any contraindications, relative or absolute, to the use of the IV drug(s) being considered.

4. Type of dental procedure being contemplated. The degree of trauma associated with a particular dental procedure must be considered when evaluating a potential sedative technique. In addition, the length of the procedure is also of importance. Proper selection of IV drugs can tailor the length of sedation to almost any duration.

5. Presence of superficial veins. The presence of suitable superficial veins is a primary prerequi-

site for elective IV sedative procedures in dentistry. Lack of suitably visible veins is an acceptable reason for selecting a technique other than IV sedation.

6. Record vital signs. Baseline vital signs are obtained at this visit if they have not yet been recorded.

7. Preoperative instructions. An example of the preoperative instructions for the patient receiving IV sedation is given below.

1. Arrangements must be made for a responsible adult to drive the patient home after the IV sedation. The patient will be unable to leave the office alone.

COMMENT: When the patient arrives in the office for treatment, the name, address, and telephone number of the escort should immediately be determined. If the procedure is planned to last up to 1 hour, the escort is requested to accompany the patient to the office and remain during the procedure. For procedures lasting more than 2 hours, the escort is still requested to accompany the patient to the office. However, the doctor may elect to permit the escort to leave the office for the duration of the procedure and to return just before the procedure is scheduled to end. In either case it is extremely important to have seen or at least spoken to the patient's escort prior to the start of the procedure.

2. The patient should have nothing to eat for approximately 4 hours prior to the procedure.

COMMENT: The attempt here is to provide an empty stomach in the unlikely event that the patient should become nauseous or vomit. There is less likelihood of aspiration if food is not present in the stomach. Patients may be permitted to ingest water or a little juice along with any medications they may be required to take. If the scheduled appointment is before noon, the patient should be told not to eat anything that morning. For afternoon-scheduled IV sedations, the patient is advised to avoid anything by mouth after 8 A.M. A light, carbohydrate-rich breakfast consisting of dry cereal and juice may be taken prior to 8 A.M. that morning.

3. The patient is advised to wear loose-fitting garments.

COMMENT: This will prevent any possibly excessive respiratory depression caused by mechanical means. The upper garment worn by the patient should be of short-sleeved length or have no sleeves so that access may readily be obtained to both arms.

4. The patient should plan to arrive in the dental office approximately 15 minutes prior to the scheduled appointment.
5. Should the patient develop a cold, flu, sore throat, or any other illness, then the appointment will be rescheduled at a time when the patient is more physically fit. The patient should call if any of these symptoms develop.
6. The medication(s) to take before the patient arrives at the office for treatment are prescribed and the name of drug, dosage, and instructions are given.
7. The time, date, and place of appointment are given to the patient.

Day of treatment

The day of the scheduled IV sedation arrives, and the patient is in the waiting room. Knowing that the patient is apprehensive about the upcoming procedure, the doctor does not want to prolong the wait any longer than necessary, since the patient's anxiety and fears will increase during this time.

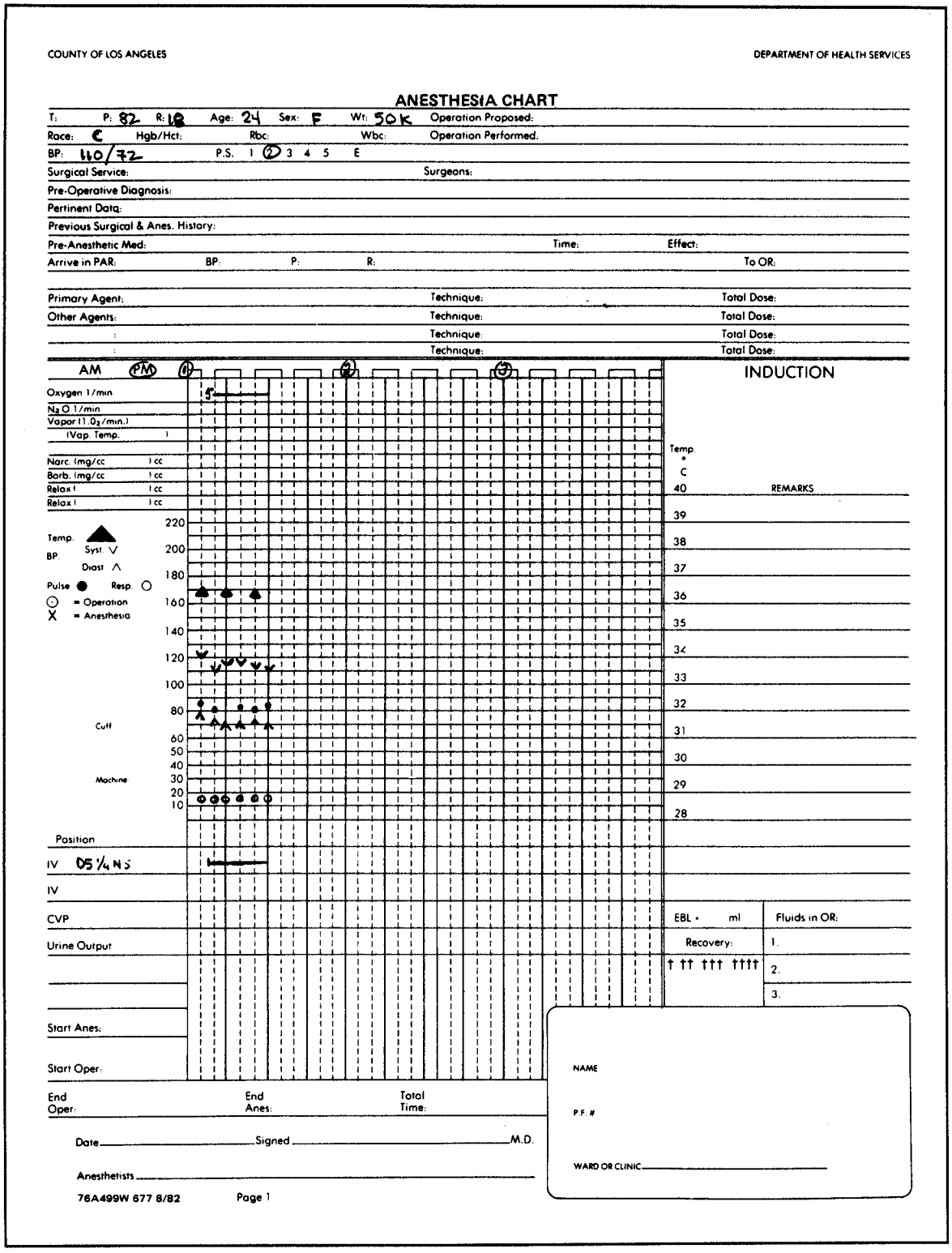
An exception to this will be the patient receiving oral premedication in addition to IV sedation. This patient should be scheduled to arrive in the office approximately 45 minutes prior to the scheduled start of the IV sedation, the medication administered, and the patient asked to remain in the waiting room.

During this time the assistant will prepare the IV infusion and drugs for use (Chapter 24). Once this is done the assistant asks the patient to go to the restroom and void if necessary, following which the patient is seated in the dental chair in a semiupright position. Also, the availability of the patient's escort should be determined at this time.

Preoperative vital signs are monitored and recorded on the anesthesia record sheet for the patient (Fig. 26-1).

After these procedures have been carried out, the monitoring devices can be placed. The blood pressure cuff is placed on the arm opposite the working side of the doctor and left in place throughout the procedure. The precordial stethoscope, ECG electrodes, and pulse monitor are also placed on the patient at this time. If O_2 (3 to 6 lpm) is to be administered during the procedure via nasal cannula or nasal hood, it may be positioned at this time.

Because of the increased possibility of phlebitis when diazepam is administered, it is suggested



COUNTY OF LOS ANGELES

DEPARTMENT OF HEALTH SERVICES

ANESTHESIA CHART

T: P: 82 R: 18 Age: 24 Sex: F Wt: 50K Operation Proposed:

Race: C Hgb/Hct: Rbc: Wbc: Operation Performed:

BP: 110/72 P.S. 1 (2) 3 4 5 E

Surgical Service: Surgeons:

Pre-Operative Diagnosis:

Pertinent Data:

Previous Surgical & Anes. History:

Pre-Anesthetic Med: Time: Effect:

Arrive in PAR: BP: P: R: To OR:

Primary Agent: Technique: Total Dose:

Other Agents: Technique: Total Dose:

: Technique: Total Dose:

: Technique: Total Dose:

AM (PM) (1) (2) (3)

INDUCTION

Oxygen 1/min 5

N_2O 1/min

Vapor (1 O_2/min.)

Vap. Temp.

Narc. (mg/cc) cc

Barb. (mg/cc) cc

Relax t cc

Relax t cc

Temp. ▲

BP. Syst. V Diast ^

Pulse ● Resp. ○

⊙ = Operation

X = Anesthesia

220 200 180 160 140 120 100 80 60 50 40 30 20 10

Cuff

Machine

Temp. °C

40 39 38 37 36 35 34 33 32 31 30 29 28

REMARKS

Position

IV D5¼NS

IV

CVP

Urine Output

Start Anes:

Start Oper:

EBL • ml

Recovery:

† †† ††† ††††

Fluids in OR:

1.

2.

3.

End Oper: End Anes: Total Time:

NAME

P.F. #

WARD OR CLINIC

Date Signed M.D.

Anesthetists

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Fig. 26-1. Preoperative vital signs are recorded and entered onto the patient's chart.

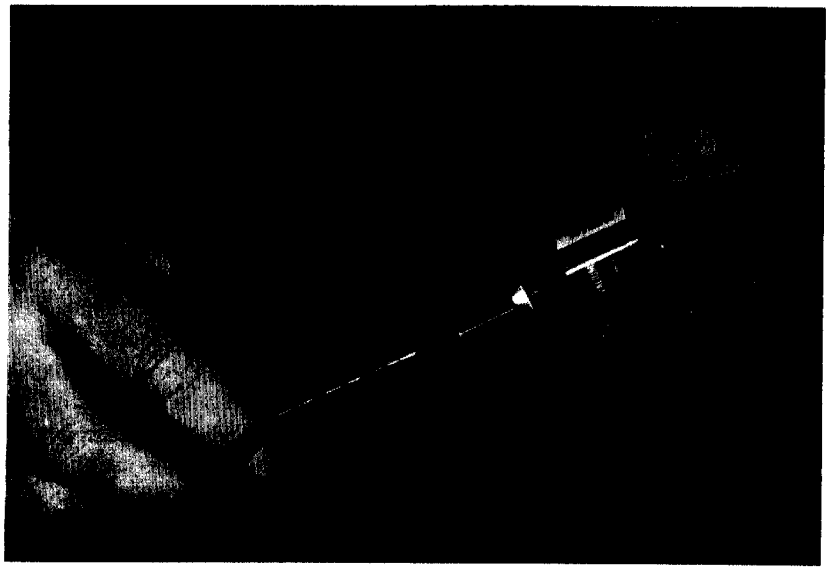

Fig. 26-2. Diazepam is withdrawn from the vial after an equal volume of air has been inserted into the vial.

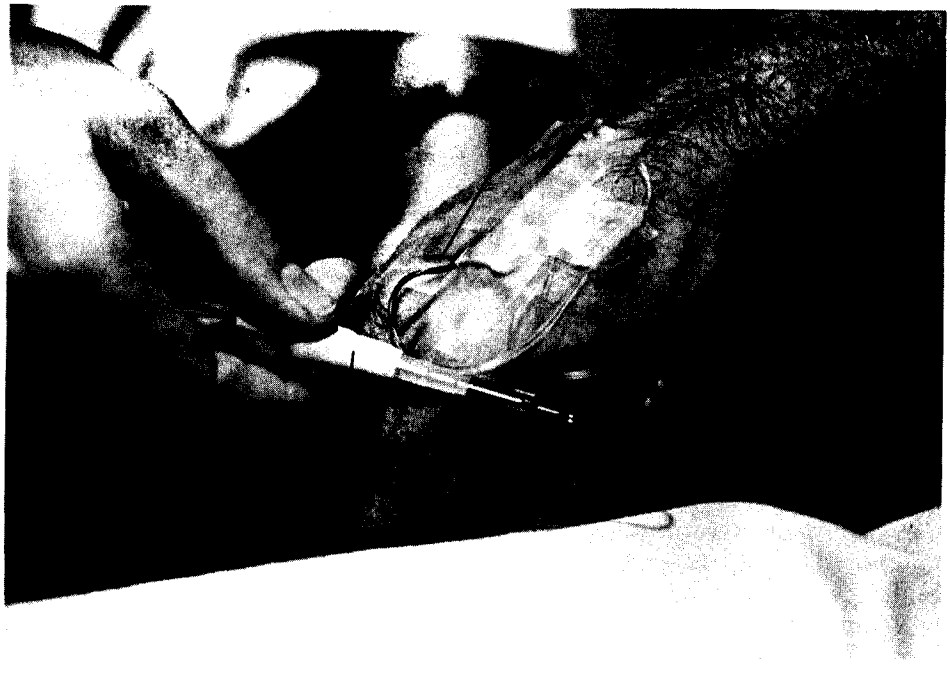

Fig. 26-3. Squeezing and releasing pressure on the flash bulb of IV tubing provides an indication of patency of the vein.

that when possible, smaller veins such as those on the dorsum of the hand or wrist be avoided when venipuncture is performed. This is not the case with water-soluble midazolam.

The venipuncture is completed, and the IV infusion is established and secured (Chapter 24).

Diazepam

Diazepam may now be administered to the patient.

The diazepam has previously been readied for use by the dental assistant. This is now reviewed.

Diazepam is available in a 10 ml vial at a concentration of 5 mg/ml. The assistant takes a sterile, disposable 3 or 5 ml syringe and after wiping the rubber diaphragm of the vial with alcohol, injects 3 ml of air into the vial of diazepam and withdraws an equal volume of the yellowish diazepam solution (Fig. 26-2). The syringe is recapped, labeled "Diazepam 5 mg/ml," and put aside for later use.

Drug administration. The patient is placed into a more supine position prior to the start of drug administration. It is good practice to open up the IV infusion so that the rate of flow is rapid during the administration of any drug. This further dilutes the drug and minimizes any local irritation that might develop as the drug comes into contact with the vein wall.

Immediately prior to starting the administration of the drug the assistant or doctor should make one final check to determine if the IV infusion is still patent. Squeezing the flash bulb of the tubing (Fig. 26-3) or holding the bag of IV solution below the patient's heart level should disclose blood in the tubing, a sign of a patent IV line.

Diazepam, being an oily,viscous liquid, has the propensity to cause the patient to complain of a burning sensation while the drug is being administered and until it is flushed from the injection site. The rapidly running IV drip will minimize this effect.

In addition, it is advisable to tell the patient that there may be a brief period of warmth while the drug is being injected, but that this is normal and will quickly subside.

A test dose of 0.2 ml (each small delineation on the syringe is 0.2 ml) is administered to determine if any unusual response is to develop.

After waiting about 15 seconds, the administration of diazepam is started. The recommended injection rate of diazepam is 1 ml per minute; this is equivalent to 5 mg per minute.

Start by administering 0.5 ml slowly and continuously in 30 seconds. Because there is great individual variation in drug response, the doctor must always be careful to titrate to each patient's precise level of sedation. The doctor continues to titrate the drug at a rate of 1 ml per minute until this ideal level is achieved.

When a doctor first begins the use of IV sedation, the tendency will be to stop administration of the drug at the very first sign of a change in the patient. For this reason, based on the uncertainty of the doctor, many patients may in fact be undersedated. As experience is gained, the doctor will develop a "feel" for the proper level of sedation.

There are signs and symptoms to be aware of:

The patient will appear to become more relaxed in the dental chair as contrasted to the patient's earlier, more tense attitude. The patient may stretch out, uncross his legs, and relax his grip on the arm of the chair.

The patient will respond to questions somewhat more slowly than previously was the case and may appear to have some difficulty in putting thoughts together.

The patient's eyelids may appear to be drooping. This is not to be the primary evaluation for proper sedation. The Verrill sign, halfway ptosis of the upper eyelid (Fig. 26-4), usually occurs when the patient is somewhat too heavily sedated.

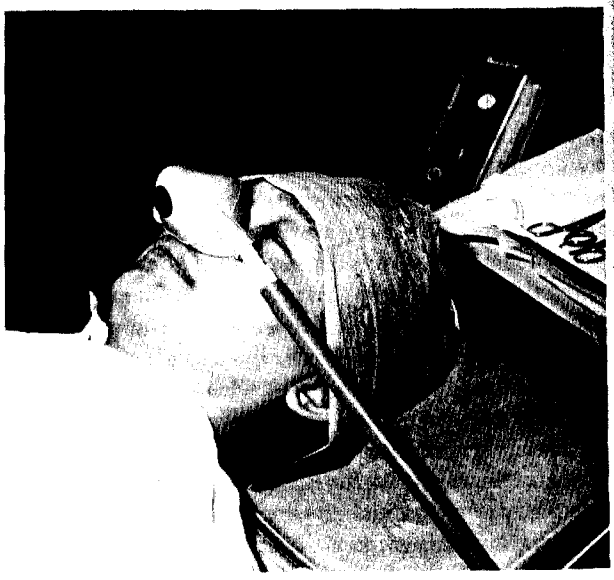

Fig. 26-4. Halfway ptosis of the upper eyelid is often seen when diazepam is employed as an IV sedative. (The patient is receiving 100% O_2 via nasal hood.)

If diazepam is administered at the proper rate, the average patient, requiring approximately 12 to 15 mg of diazepam, will be sedated within 3 to 4 minutes of the start of drug administration.

Once the proper level of sedation is achieved, the rate of the IV infusion must be slowed. Whenever a drug is not being administered, the infusion rate is adjusted to approximately 1 drop every 5 to 10 seconds. The goal now is to keep the needle from becoming clotted with blood during the procedure.

Immediately following the completion of diazepam administration the assistant records the vital signs and the drug dose on the anesthesia record. Vital signs should be recorded immediately following subsequent drug administration and at 10- to 15-minute intervals throughout the procedure.

Dosage. The average dose of diazepam required to achieve clinically adequate sedation is between 12 and 15 mg (average of over 2000 cases). The range of doses is of greater importance, for it illustrates the great individual variability in response to this agent. In my experience with diazepam as a sole agent for sedation, clinically adequate sedation has been achieved with as little as 3 mg in some patients, whereas others have received in excess of 30 mg and have not even approached the same level of sedation.

The following is strongly recommended as a procedure for determining the maximal dose of diazepam for a given patient.

Diazepam is titrated at a rate of 5 mg (1 ml) per minute until adequate sedation is achieved. As mentioned, the usual dose required to achieve this effect is between 12 and 15 mg. Once the desired clinical effect is achieved, the intraoperative phase of treatment is begun.

If the patient has received a total of 20 mg of diazepam and has demonstrated some sedation, although not quite at the desired level, additional diazepam may be titrated up to a total of 25 mg.

On the other hand, if the patient has received 20 mg of diazepam but is exhibiting virtually no signs and symptoms of sedation, it is prudent to stop diazepam administration at this point. Experience with diazepam has demonstrated that when adequate sedation is not achieved by 20 mg, the addition of another 10 or 20 mg probably will not prove beneficial to the patient but may in fact increase the risk of complications. My recommendation is that if a dose of 20 mg diazepam fails to produce any sedation, the administration of diazepam should be terminated and dental therapy be attempted without the addition of any additional drugs.

The doctor experienced with IV sedation and general anesthesia will have several options available at this time, but in the hands of the doctor without general anesthesia training, the most prudent course of action at this time is to cease drug administration and begin the dental procedure. I continue to be surprised by the number of dental patients, apparently without any signs or symptoms of sedation, who do extremely well and who have a degree of amnesia at the end of the procedure.

Should this attempt at treatment fail, the patient should be dismissed (following recovery) and rescheduled for a different IV sedation technique at a later date.

Diazepam

Average sedative dose	12 to 15 mg
Sedative dose range	3 to > 30 mg
Maximal dose—no sedation	20 mg
Maximal dose—some sedation	25 mg

Intraoperative period. Local anesthesia is administered to the patient exactly as it would be done if the patient were not sedated. This includes the use of topical anesthestic and all of the other steps involved in the atraumatic administration of local anesthestics. The patient may react to any discomfort associated with the injection, but usually this is simply a slight moan, grimace, or slight movement. Adequate time for the local anesthetic to take effect should be ascertained before beginning dental treatment.

During the first 3 to 5 minutes after diazepam administration the level of sedation will be at its greatest. Although overresponse to diazepam is unlikely, the patient who has overresponded to diazepam may be somewhat sluggish in response to verbal commands such as "open your mouth." For this reason, the use of a mouth prop should be considered, at least at the beginning of the IV diazepam procedure. Within 5 or 10 minutes the level of sedation has usually decreased so that the patient's mouth can be voluntarily kept open. A rubber bite block with a piece of string (dental floss) tied around it or a ratchet-type (Molt) mouth prop may be used at this time.

Lack of patient response to verbal command and more significantly a lack of response to pain (i.e., local anesthetic injection) may indicate that the patient is overly sedated. Lack of response *al-*

ways indicates that the doctor should stop the procedure and reevaluate the patient's airway and ventilatory status.

Following the administration of local anesthesia, a rubber dam should be applied, if feasible for the planned procedure. A rubber dam serves two important functions during IV sedation:

- It aids in maintaining the mouth in an open position (it may be used in place of the mouth prop).
- It prevents extraneous materials from falling into the posterior part of the mouth, throat, and pharynx.

Dental treatment begins at this time. Because of the 45-minute duration of sedation provided by diazepam, dental treatment should be planned to fit this time period. Also, diazepam produces a period of anterograde amnesia in approximately 75% of patients, and this amnesic phase lasts approximately 10 minutes. Thus potentially painful or traumatic procedures should be completed at the start of the treatment.

In this manner, as the sedative effect begins to wane (about 30 minutes into the procedure), relatively innocuous procedures will be performed, such as packing alloys, suturing, or adjusting occlusion. In addition, having received local anesthesia earlier, the patient will be pain free at this time and will be able to tolerate these procedures without complaint. In most patients the duration of treatment with one dose of diazepam can usually be extended well beyond 1 hour, because of the lack of pain and the relative innocuousness of the procedures being carried out at this time.

It is very rare that a patient will require a second dose of diazepam, if the duration of the planned dental procedure was appropriate (about 1 hour). As was discussed in Chapter 25, diazepam sedation may be divided into three phases. In the third phase the patient will state that he feels normal once again, and the doctor might be tempted to readminister additional diazepam. However, at this time the dental procedure is nearly completed, the procedure being performed is atraumatic, the patient has effective local anesthesia, and although the patient feels normal, he is still anxiety free if not obviously sedated. Thus it is clear that readministration of diazepam is rarely necessary.

Occasionally readministration might be necessary for successful completion of the dental procedure. For example, a patient is scheduled for restorative procedures with IV diazepam. All goes well, but one of the teeth requires endodontic therapy. The patient begins to become increasingly aware of the proceedings approximately 40 minutes into the procedure and is becoming somewhat apprehensive again. The doctor has two options: first, to temporarily fill the canal, dismiss the patient, and reschedule for another visit; and second, the doctor can retitrate additional diazepam and continue with the endodontic therapy at the same visit.

Should the decision be made to retitrate and to continue treatment, the assistant will increase the rate of the IV drip, and the doctor slowly titrates additional diazepam until the patient becomes sedated once again or until a total dose of 30 mg diazepam has been reached. Following retitration, the IV drip rate is slowed again and treatment continued.

Retitration with diazepam will always require a smaller dose than that required earlier. For example, if 18 mg were required at first, a dose of 3, 8, or 12 mg might produce the same clinical level of sedation with retitration. For reasons that will be explained in Chapter 27, the total, combined dose of diazepam administered at one appointment should be kept under 30 mg.

If diazepam is readministered, the dental assistant should record the vital signs on the anesthesia record sheet.

Posttreatment period. Following the completion of the dental treatment, the IV infusion may be discontinued if in the opinion of the doctor there will be no further need for it. The patient should be responding normally at this time, no adverse or bizarre signs or symptoms being present (e.g., emergence delirium). The technique for termination of the IV infusion is discussed in Chapter 24. The nasal O_2 can also be terminated at this time.

Recovery criteria. The patient is *never* discharged from the office alone following IV sedation, regardless of the patient's apparent state of recovery or the degree to which the patient protests. Criteria for discharge from the office will include monitoring of the vital signs and the reaction of the patient.

Vital signs should be approximately at the baseline level (taken at the preliminary visit). If blood pressure appears significantly depressed (more than 30 mm Hg below baseline) and clinical signs and symptoms of sedation are present, the patient should be permitted to recover for a few more minutes while receiving O_2.

The most important criteria for discharge will be the response of the patient. Under no circumstances should the patient be permitted to leave the office feeling poorly or unable to walk unaided. In some cases the patient may feel dizzy, mildly nauseous, or weak. In these cases the patient should be permitted to rest until he feels more recovered (thus the importance of a recovery area in the dental office supervised by a well-trained assistant). A sedated patient must never be left unattended in any room; the doctor or a trained member of the staff should be physically present at all times.

When it is believed that the patient has recovered sufficiently, all monitoring devices are removed and the patient is permitted to stand. A member of the dental team, the doctor or assistant, should position himself or herself in front of the patient so that if the patient's legs are a little weak, the staff person can aid the patient and thus prevent possible injury and litigation.

The position of the chair is adjusted from the semisupine to a 90-degree position. This should be carried out slowly, preferably in several steps, thus allowing the patient's cardiovascular system to readjust to the effects of gravity, preventing postural hypotension, possible dizziness, and syncope.

The patient first sits with legs touching the floor. Then the patient stands. If the patient is able to do this with little difficulty (with diazepam and midazolam there is rarely difficulty in standing after 45 minutes), the patient is requested to take a few steps toward the doctor or assistant. If all is well, the patient is reseated in the dental chair.

The foremost criterion in permitting patients to be discharged from the office is their ability to take care of themselves should for any reason they be left alone during the remainder of the day. They should be able to walk without much difficulty. If such is not the case, the patient is allowed additional recovery time.

When diazepam or midazolam is employed for IV sedation, clinical recovery usually appears to be quite complete at 45 to 60 minutes. However, when other medications are employed, recovery may not appear nearly as complete.

Once recovery is deemed to be adequate for discharge, the patient is reseated in the dental chair and the escort is called in from the waiting room. In the presence of both persons posttreatment orders are given verbally and in writing. It is potentially possible, though highly unlikely, that the patient may still be amnesic at this part of the procedure. Therefore the presence of the companion and the written instructions are necessary. Any instructions given to the patient should be recorded on the anesthesia record sheet and/or in the patient's dental chart.

The usual postoperative instructions following IV sedation are presented below. Additional instructions should be included if necessary because of the nature of the dental treatment. This might include restrictions on diet or the need for ice or heat applications. Once again, these are given in the presence of the escort, given to the patient in writing, and recorded on the patient's chart.

The companion accompanies the patient out of the office. A member of the dental staff should remain with the patient until the patient is placed into the car and the seat belt fastened.

The anesthesia record sheet and the patient's dental chart are completed, the disposable IV equipment (needle, tubing, and infusion solution) is discarded, and any unused drug is disposed of. A note in the chart and anesthesia record sheet is made: "*x* mg diazepam discarded." Recording of

POSTSEDATION INSTRUCTIONS

1. Go home and rest for the remainder of the day.
2. Do *not* perform any strenuous activity. You should remain in the company of a responsible adult until you are fully alert.
3. Do not attempt to eat a heavy meal immediately. If you are hungry, a light diet (liquids and toast) will be more than adequate.
4. A feeling of nausea may occasionally develop after IV sedation. The following may help you to feel better:
   a. Lying down for a while
   b. A glass of a cola beverage
5. Do not drive a car or perform any hazardous tasks for the remainder of the day
6. Do not take any alcoholic beverages or any medications for the remainder of the day unless you have contacted me first.
7. The following medication(s) have been ordered for you by the doctor. Take them only as directed below:
8. If you have any unusual problems you may call (office telephone number).

Patient Name: John Smith Date: 2-14-84

IV infusion was started at 9:15 a.m./p.m. with a 21 gauge Butterfly needle in (L) AC FOSSA.

height/weight: 6' 182 LBS pre-op

TIME (1 box = 15 minutes)

	9:10	9:25	9:40	9:55	10:10																	
B.P.	116/84	120/84	110/80	110/80	110/80																	
Pulse	62	80	64	64	64																	
Resp	18	20	16	16	16																	
N_2O_2 %																						
2% Lidocaine 1/100		1.5cc																				
2% Lidocaine 1/50																						
2% Carbocaine 1/20																						
4% Citanest 1/200																						
mg. Valium (5 mg/ml)	11																					
mg. Scopolamine																						
mg. Demerol (50 mg/ml)																						
mg. Nembutal (50 mg/ml)																						
mg.																						
mg.																						
mg.																						
mg.																						

The procedure lasted 1 hrs. 05 minutes and the patient received 180 ml of D5W. The patient tolerated the procedure well and was discharged at 1030 a.m./p.m. in good condition to the custody of MARY SMITH. Postoperative instructions were given verbally to the patient and the companion.

AMED Faculty Signature: KU Student: —

Fig. 26-5. Complete sedation record for an IV diazepam procedure.

the disposition of all drugs, especially the schedule II barbiturates and narcotic agonists, is a very necessary part of the IV procedure.

Fig. 26-5 illustrates a typical anesthesia record sheet at the completion of the IV procedure.

The following is a sample of the record that should be placed in the patient's chart, if the anesthesia record sheet is not available in its place:

IV started with a 21-gauge scalp vein needle in the left ventral forearm. The patient received 13 mg diazepam in one dose. The procedure lasted 45 minutes, the patient receiving 5 lpm 100% O_2 via nasal hood throughout the procedure. A total of 180 ml of 5% dextrose and water was administered. The patient tolerated the procedure well and was discharged from the office in the custody of Mr. John Smith. Postoperative instructions were given verbally and in writing to both the patient and companion.

	Blood pressure	*Heart rate*	*Respiration*
Baseline:	124/68	66	17
Preoperative:	132/74	78	16
Postsedation (diazepam):	128/70	74	14
Postoperative:	124/72	74	16

Though this may appear to be quite voluminous, especially considering the usual entry on the dental chart, this type of record keeping is absolutely essential whenever sedative procedures are employed. There should be no doubt at a later date as to exactly what transpired during the sedative procedure.

One more important task remains: each and every patient who receives IV (or IM) sedation should be contacted by telephone, by the doctor, just before he or she leaves the office in the afternoon, if the IV was in the morning or later that evening if the IV was during the afternoon. This is one of the most important actions that a professional can perform for the patient. It demonstrates to the patient the sincerity and concern on the part of the doctor and is a means of circumventing potential problems (such as developing pain or bleeding) before they become more significant. This conversation is recorded in the patient's chart.

Midazolam

The technique of IV sedation using midazolam is similar to that just described for diazepam with the following exceptions.

Midazolam is available as a 5 mg/ml solution that should be diluted to a 2.5 mg/ml form prior to its administration. This is accomplished by tak-

ing the contents of a 2 ml ampule of midazolam and adding it to a syringe containing 2 ml of a suitable diluent, such as 5% dextrose and water, normal saline, or lactated Ringer's solution.

Because midazolam is water soluble, the IV infusion may be established at any venipuncture site.

Midazolam is administered at a rate of 2.5 mg per minute (1 ml per minute).

The range of doses required for sedation in the one published study (Young, 1983) was between 2.5 and 7.5 mg.

The duration of sedation is approximately equivalent to that produced by diazepam or perhaps a little shorter; however, the amnesic phase provided by midazolam is of greater length.

Recovery from midazolam sedation is similar to diazepam, with the patient appearing to have completely recovered within the space of 1 hour.

The use of diazepam or midazolam for sedation provides a duration of sedation of approximately 1 hour. Many dental procedures today, however, require longer periods of time for their completion.

The Jorgensen technique

The Jorgensen technique is a combination of three drugs that provide sedation for periods of time of greater than 2 hours. Niels Bjorn Jorgensen first employed this technique, which he called *intravenous premedication* in 1945 at the Loma Linda University School of Medicine. Jorgensen introduced the technique because of his dissatisfaction with the oral and intramuscular routes of precise and reliable level of sedation than was possible by any of the other techniques then available.

This technique has been employed successfully at the Loma Linda University School of Dentistry in excess of 13,000 times since 1965. Originally designed to be used during oral surgical procedures, its effectiveness in all branches of dentistry has been reaffirmed many times. The technique became known as the *Loma Linda technique* because of Jorgensen's affiliation with that school, and is now known as the Jorgensen technique, after the man who is considered by many to be the father of IV sedation in dentistry.

Three drugs are administered in the Jorgensen technique:

1. Pentobarbital, a barbiturate
2. Meperidine, a narcotic agonist
3. Scopolamine, an anticholinergic agent

As will be mentioned later in this chapter, polypharmacy, the use of multiple drugs to achieve a therapeutic goal, is to be avoided whenever possible, for the possibility of drug-drug interactions increases greatly as additional drugs are added. The Jorgensen technique is an example of polypharmacy, but unlike most other drug combinations it is a rational combination.

Everett and Allen (1971) reported on a study of the physiological effects of the Jorgensen technique and demonstrated that there is minimal physiologic alteration produced, although three of their subjects did develop nausea. This effect is most likely caused by the narcotic. In my experience with this technique nausea and vomiting occur extremely rarely and are not significant complications.

Function of the individual drugs

Pentobarbital. Pentobarbital is the drug that is used to produce the desired level of sedation in the Jorgensen technique. Pentobarbital is the drug that provides the technique with its 2 to 4 hour duration of action. Pentobarbital, being a generalized CNS depressant, has the disquieting effect of making patients more likely to overreact to stimulation. This is a negative feature of the drug and is one reason for inclusion of the narcotic in the technique.

Meperidine. Meperidine is a narcotic agonist and as such has a great number of potentially adverse side effects, including respiratory depression, postural hypotension, nausea, and vomiting. Its functions in this technique are threefold:

- Provides some additional sedation
- Provides some analgesia, thus counteracting the negative effect of the barbiturate
- Provides some euphoria

In the dosages of meperidine employed in the Jorgensen technique (not greater than 25 mg) the major effect produced by meperidine is its analgesic effect. Patients who have received pentobarbital alone overrespond to painful or traumatic stimulation; however, with the addition of up to 25 mg of meperidine this response is moderated, most patients responding "normally" to stimulation.

Scopolamine. Scopolamine is an anticholinergic agent with several functions in the Jorgensen technique. Scopolamine provides anterograde amnesia in many patients. It inhibits salivary secretions, thus providing the doctor with a dry field and produces a degree of CNS depression, al-

though this rarely is of any significance. Scopolamine may produce emergence delirium, and is contraindicated for use in patients under age 6 years and over age 65 years.

Preliminary appointment

At the visit prior to actual treatment the patient will be evaluated as discussed in the diazepam technique section.

The Jorgensen technique is described to the patient in general terms, mentioning that the medications will be administered intravenously and that the patient will feel quite relaxed, perhaps somewhat sleepy. It is important to mention to the patient that they will not be unconscious, for this is not general anesthesia, but a safer, equally effective technique called sedation.

The patient's previous reactions to the drugs involved in the technique must be determined. Whether the patient has ever received Nembutal, Demerol, or scopolamine is determined, and if so, the patient's reaction is noted. In addition, the patient is questioned about the presence of possible contraindications to the use of one or more of these agents. These include the following:

1. Allergy or hypersensitivity to any of the three drugs
2. Porphyria (contraindication to barbiturate)
3. Liver disease (contraindication to barbiturate, narcotic)
4. Asthma (contraindication to barbiturate, narcotic, scopolamine)
5. Respiratory depression (contraindication to barbiturate, narcotic)
6. Alcoholism (contraindication to barbiturate, narcotic)
7. MAOIs within 14 days (contraindication to narcotic)
8. Glaucoma (contraindication to scopolamine)
9. Adhesions between iris and lens (contraindication to scopolamine)
10. Prostate disease (contraindication to scopolamine)
11. Myasthenia gravis (contraindication to scopolamine)
12. Contact lenses (contraindication to scopolamine)

Baseline vital signs are recorded, preoperative instructions are given to the patient, and the sedation appointment is scheduled.

Day of treatment

On the day of treatment the patient is prepared for the procedure as was described for diazepam sedation. Because this will be a longer procedure than diazepam, the importance of having the patient void prior to the start of the procedure is stressed.

Preparation of drugs. When the drugs for use in the Jorgensen technique are prepared, two 5 ml syringes are employed. The drugs are available as follows:

Pentobarbital: 50 mg/ml in 2 ml ampules and multidose vials
Meperidine: 25 mg/ml in 0.5 and 1 ml ampules
Scopolamine: 0.3 mg in 1.0 ml ampules

Into the first syringe is placed 3 ml (if the multidose vial) or 4 ml (two 2 ml ampules) of pentobarbital. The syringe is labeled: "Pentobarbital 50 mg/ml."

To remove a drug from an ampule the doctor or assistant holds the ampule in the fingers as illustrated in Fig. 26-6. A gauze square is used to prevent injury from sharp pieces of glass. Making certain that all of the drug is in the bottom of the ampule, the doctor or assistant cracks the glass at its prescored neck. A microfilter needle is placed

Fig. 26-6. Ampule is held in gauze and cracked at its prescored neck.

onto the syringe, and the solution is drawn up into the syringe. The micropore filter is designed to stop any small fragments of glass that may have fallen into the solution from entering the syringe and being injected into the patient. After the syringe is filled with solution, the micropore filter needle is replaced with the original needle. The filter needle can be used in only one direction: either to withdraw solutions *into* the syringe or to inject them *out* of the syringe, and it must be replaced by the original needle for the other function.

When a drug is removed from a multidose vial, the rubber stopper is cleansed with an alcohol wipe and permitted to dry. Placing the needle of the syringe into the bottle at an angle to prevent coring (the placing of small pieces of rubber into the solution) a volume of air equal to the volume of solution to be withdrawn is injected into the vial. This makes it much easier for solution to be withdrawn from the vial.

In the second syringe will be placed meperidine (25 mg), scopolamine (0.3 mg), and a volume of diluent that may be withdrawn from the IV infusion bag. Assuming in this instance that the meperidine ampule contains 25 mg in 0.5 ml and the scopolamine contains 0.3 mg in 1.0 ml, the doctor or assistant must first insert the empty syringe into the injection site on the IV infusion bag or the injection site on the IV tubing and withdraw 3.5 ml of solution. Each of the ampules is carefully opened and its contents withdrawn into the syringe. A total of 5 ml of solution should now be in the syringe, containing 25 mg meperidine and 0.3 mg scopolamine. The syringe is labeled: "Meperidine 5 mg/ml, scopolamine 0.06 mg/ml."

The patient is positioned in a semisupine position, monitoring devices are placed, preoperative vital signs are recorded, and the venipuncture is established. There are no limitations on the site of venipuncture for any of the drugs employed in the Jorgensen technique.

Nasal O_2 through either a cannula or nasal hood at a rate of 3 to 6 lpm is recommended at this time.

The rate of the IV infusion is increased, and the patency of the IV infusion is rechecked. The pentobarbital syringe is placed into the injection site on the IV tubing, and a test dose of 0.2 ml of solution (1 small delineation on the syringe) is administered to rule out any allergic reaction or hypersensitivity response.

After 30 seconds the doctor or assistant begins the administration of pentobarbital at a rate of exactly 10 mg every 30 seconds (0.2 ml or 1 small delineation) while continuously conversing with the patient.

The pentobarbital is continuously injected until the patient mentions the presence of the first symptoms of cortical depression. These usually are the following:

- Slight dizziness
- A feeling of being tired
- Decreased apprehension
- Difficulty in focusing on distant objects

Clinical signs that may be noted at this time are the following:

- Relaxation in those who were initially agitated
- Slight slurring of speech
- Slower response to commands
- Heaviness of the eyelids

It is advisable to place a mouth prop in the patient's mouth at this time so that should the responses become even more sluggish the patient will have no difficulty in maintaining an open mouth.

It is important to administer the pentobarbital at a slow rate, for the lag time between injection and onset of clinical signs and symptoms is somewhat slower than diazepam and midazolam, approximately 2 to 4 minutes. In other words, the clinical effect being seen at this moment is produced by the pentobarbital adminstered up to 4 minutes earlier.

Jorgensen termed the point of appearance of the first signs of cortical sedation "baseline." The dose of pentobarbital is noted at this point. The average dose required to reach this level is between 125 and 175 mg. However, the range is quite broad, baseline sedation having been achieved with pentobarbital doses from 30 to 300 mg.

In Jorgensen's original description of this technique it was stated that at this point an additional amount of pentobarbital is injected equal to 10% to 15% of the baseline dosage. Thus if 100 mg was required to reach baseline, an additional 10 to 15 mg will be injected and the syringe removed. Having used this technique for 11 years I have found that this additional 10% to 15% need not always be administered, for in many patients this additional dose will lead to a greater depth of sedation than is desired. Additional pentobarbital can always be administered, but once the drug is

Table 26-1. Ratio of barbiturate to meperidine in Jorgensen technique

Barbiturate dose (mg) (syringe 1)	*Maximal meperidine dose (syringe 2)*	
	Milligrams	*Milliliters*
30	7.5	1.5
50	12.5	2.5
60	15	3
80	20	4
100	25	5
200	25	5
300	25	5

administered, there is no way of removing it or of reversing its actions.

Having achieved baseline sedation, the second syringe containing meperidine and scopolamine is placed into the injection site. The rate of injection is based on the meperidine: it is recommended that it be deposited at a rate of 10 mg per minute, or in this instance 1 ml every 30 seconds.

The maximal dose of meperidine is based on the dose of pentobarbital required to reach baseline sedation. The ratio of pentobarbital to meperidine will be 4:1 mg up to a maximal dose of 25 mg meperidine (Table 26-1). Thus a patient who received 100 mg pentobarbital may receive up to 25 mg meperidine. If 60 mg pentobarbital was required, a maximal dose of 15 mg meperidine may be administered. If the patient required 180, 200, or 300 mg pentobarbital to reach baseline, the maximal meperidine dose is still 25 mg. *In no case is more than 25 mg meperidine administered.*

As the meperidine-scopolamine combination is being administered the patient must be observed carefully for signs of increasing sedation. In most instances no noticeable change in depth of sedation will occur, and the maximal calculated dose of meperidine-scopolamine will be administered.

In some instances, however, it will be observed that the patient is becoming more deeply sedated as the meperidine is administered. In this situation the administration of meperidine-scopolamine should be halted *before* the patient reaches an overly deep level of sedation and the maximal calculated dose not administered.

The rate of the IV infusion is now slowed to a rate just fast enough to keep the needle from occluding.

Vital signs are recorded on the anesthesia record sheet.

This combination of pentobarbital (for its sedation), meperidine (for its analgesia, euphoria, and additive effects with pentobarbital), and scopolamine (for its amnesic and antisialogogue actions) usually results in a cooperative, relaxed, and sedated patient who willingly accepts 2 or more hours of concentrated restorative or surgical procedures under local anesthesia yet remains conscious and able to assist the dentist when necessary.

Intraoperative period. Local anesthesia is administered and treatment begun. Although virtually all patients will be well sedated and cooperative at this point, it is possible that some few will begin to react when treatment is commenced. This may be an indication for the administration of additional pentobarbital or local anesthetic to the patient. If it appears that the patient's movements are related only to painful dental procedures (e.g., excavating cavities, soft tissue surgery) but that they resolve when treating enamel, pain control may be incomplete and additional local anesthetic should be readministered. However, if the patient's movements are more generalized—occurring in response to nontraumatic procedures—the patient is asked how he is feeling. If the patient responds that he is still fearful of the procedure the infusion rate is increased, and additional pentobarbital is titrated until relaxation is increased. The pentobarbital is responsible for the proper level of sedation in the Jorgensen technique. Once an appropriate sedation level is achieved, the syringe is removed, the IV infusion rate is slowed, and no more meperidine-scopolamine is administered.

However, in the event that there is a sluggish or absent response, additional drug is not administered. The patency of the airway is checked immediately. Hypoxia is often clinically expressed as restlessness. Ventilation is assessed and controlled if necessary until the patient recovers sufficiently.

The duration of the ideal depth of sedation during the Jorgensen technique will be considerably longer than that seen with diazepam or midazolam. Recovery is also somewhat slower—the patient appears sedated even after 3 or 4 hours of treatment.

The following are several points to be aware of during treatment of the sedated patient:

1. Work efficiently and quietly. Remember that

your patient is awake and able to hear you. Be careful in what you do and say while treating the sedated patient, who may not hear every word that you utter and may misinterpret your words. Be especially careful where you place your hands and instruments. The patient may consider a perfectly innocent gesture as an assault on his or her body (Chapter 17).

2. When the patient is female (or male if the operator is female), it is important medicolegally for another female to be present in the room with you at all times during the procedure.

3. Some patients may complain about the dryness that accompanies the administration of scopolamine. It may be necessary for the doctor or assistant to moisten the soft tissues of the patient's mouth and throat with small squirts of water from the air-water syringe.

Posttreatment period. Recovery from the Jorgensen technique is considerably less complete than that seen with diazepam or midazolam. This is beneficial to a degree because the patient is not likely to want to drive a car or do other potentially hazardous duties after sedation with the Jorgensen technique. The typical patient simply wants to go home and go to bed and sleep.

Recovery will be based on the patient's ability to walk without assistance and on a comparison of the vital signs obtained before, during, and after the procedure, as described in the discussion on diazepam and midazolam.

Record keeping on the patient's dental chart will include the anesthesia record sheet or a written statement similar to that recommended for diazepam.

Postoperative instructions are given verbally and in writing to the patient and companion. Postoperative analgesics administered during the first 6 to 8 hours should be milder analgesics, so as to minimize any additive effects of narcotics with the agents used intravenously. If pain is expected to be a significant problem postoperatively, administration of a long-acting local anesthetic, such as bupivacaine or etidocaine, immediately prior to discharge of the patient is suggested.

The patient is escorted from the dental office by a companion and a staff member and contacted later that day to see how the recovery is progressing.

There is a greater possibility that the patient will not be fully recovered from the effects of the pentobarbtal the next day, especially if the sedation procedure occurred during the afternoon. It is preferable therefore for sedation with the Jorgensen technique to be carried out during the morning hours.

Intravenous promethazine

The third of the basic techniques of IV sedation is the administration of promethazine, a phenothiazine derivative with potent sedative and antihistaminic properties. Because promethazine does possess antihistaminic and anticholinergic properties, the addition of an anticholinergic, such as atropine or scopolamine, is unwarranted.

The primary use for promethazine will be for the dental procedure expected to require between 1 to 2 hours. Procedures less than 1 hour are well managed with diazepam or midazolam, whereas for procedures of more than 2 hours the Jorgensen technique is recommended.

The following relative and absolute contraindications to promethazine use must be sought at the preoperative visit:

1. Allergy or hypersensitivity to promethazine
2. Glaucoma
3. Prostatic hypertrophy
4. Stenosing peptic ulcer
5. Bladder/neck obstruction

If any of these are present, alternative IV procedures should be sought. Diazepam or midazolam is recommended in place of promethazine for most of these patients. The Jorgensen technique is not as suitable, primarily because these same contraindications are present for the anticholinergics used in that technique.

The IV infusion may be established at any convenient site when promethazine is used.

The solution consists of 3 ml of 5% dextrose and water put into a 5 ml syringe and then 2 ml of promethazine (25 mg/ml) is added. This produces a concentration of 10 mg/ml, the recommended concentration for injection of promethazine.

The drug is slowly titrated at 1 ml per minute to effect. The average dose of promethazine required for sedation is 32.5 mg, the range between 25 and 35 mg. If adequate sedation is not present at 50 mg, drug administration is terminated and treatment is begun if possible or the patient is rescheduled for another appointment at which a different technique will be used.

Although readministration of promethazine is usually not required once the initial titrating dose

has been given, readmission may be necessary on rare occasion. In this event the recommended absolute maximal dose of promethazine is 75 mg.

Promethazine	
Average sedative dose	32.5 mg
Sedative dose range	25 to 35 mg
Maximal dose—no sedation	50 mg
Maximal dose—some sedation	75 mg

Recovery from promethazine sedation is not as clinically complete as that for diazepam or midazolam, the patient still retaining some degree of CNS depression on departing from the office.

Summary

Three techniques that I have classified as basic have been presented. I believe that these techniques should form the backbone of the doctor's IV sedative armamentarium. When these techniques are used exactly as described, complications will not arise. Retrospective studies on the Jorgensen technique and IV diazepam have demonstrated beyond doubt that these procedures are sound, safe, and effective.

Availability of these three procedures will permit the doctor to pick an appropriate technique based on the time allotted for treatment:

Up to one hour: diazepam or midazolam
From 1 to 2 hours: promethazine
More than 2 hours: Jorgensen technique

In addition, the following applies to IV drug administration:

- Always titrate the drugs slowly.
- Always remain within the dosage limits recommended for each technique.

Failures (inability to provide adequate sedation with the dosage recommended), though quite rare, will occur. When this happens, *no other medication is to be administered to the patient* (and this includes N_2O-O_2. An attempt is made to treat the patient in the best possible manner. If this proves impossible, the procedure is rescheduled at another time at which a different technique will be used. The administration of additional drug or of a different drug to the patient will frequently lead to problems. Finding out the hard way that this is true is not recommended.

MODIFICATION OF BASIC TECHNIQUES

In this section a common modification of a basic technique is described, the addition of an anticholinergic medication to diazepam or midazolam. The Jorgensen technique already includes an anticholinergic, and promethazine possesses anticholinergic properties so that addition of another drug is unwarranted.

The selection of a suitable anticholinergic is based on the needs of the patient and the desired duration of action.

In cases in which a degree of sedation and amnesia is warranted, scopolamine (0.3 mg) is recommended. Its use is appropriate in a procedure of any duration.

If the patient is younger than 6 years old or more than 65 years old, scopolamine is not recommended because of the increased incidence of emergence delirium.

Atropine (0.4 mg) is employed in cases in which a drying effect is desired without amnesia or additional sedation, and the duration of the procedure is less than 2 hours.

Glycopyrrolate (0.2 mg) is recommended for procedures in excess of 2 hours when a drying effect is required.

Table 26-2 summarizes the properties of anticholinergics.

Technique

When these drugs, which are aqueous solutions, are administered with diazepam, which is lipid soluble, they must be administered separately. The patient receives diazepam as discussed previously, and the anticholinergic is then administered. Slowly inject the anticholinergic drug over a 1-minute time span.

The use of diazepam and scopolamine (0.3 mg) will provide a greater degree of amnesia in most patients than either drug alone. Rather than the

Table 26-2. Indications for anticholinergics

	Salivary secretions	*Amnesia*	*Sedation*	*Duration (hours)*
Atropine	+	−	−	<2
Glycopyrrolate	+	−	−	>2
Scopolamine	+	+	+	Any length

amnesic period being approximately 10 minutes in duration, it may extend over the entire appointment.

Being water soluble, midazolam and anticholinergics may be mixed in a single syringe prior to administration and injected together.

One of the disadvantages of employing anticholinergics is that some patients will complain that the drying effect is bothering them, both during the procedure and in some cases following the procedure when they return home. Although drugs are available to reverse this effect of anticholinergics (the reversible cholinesterases, neostigmine, and physostigmine) their use is not recommended (because of undesirable side effects).

ADVANCED TECHNIQUES

In this section several techniques will be discussed that include the addition of a narcotic to an antianxiety or a sedative hypnotic drug. The box on p. 366 presents the categories of drugs discussed in this section.

When used for a well-defined purpose, the combination of one drug from group A and one from group B is quite rational. As was just discussed above, the addition of an anticholinergic (group C) is suggested whenever a drying effect or amnesia is desirable.

The use of the techniques described in this section should be limited to two groups of doctors:

1. Doctors trained in general anesthesia techniques and in the management of the airway of an unconscious patient.
2. Doctors with extensive experience in the basic techniques of IV sedation.

Because these techniques involve the administration of two CNS depressants, there is slightly greater possibility of additive drug effects developing. Clinically this would lead to an increased depth of sedation, and might require the doctor to terminate dental treatment momentarily and evaluate the patient.

When the drugs listed here are employed exactly as recommended (dosage and rate of injection), clinical problems are extremely unlikely to develop. Deviation from these guidelines will increase the potential for adverse side effects.

Rationale

Why am I discussing the addition of a second drug to the basic sedative procedures discussed above? There are two reasons.

First, maximum safe and effective doses of each of the basic drugs were presented. If no clinical effect of the agent has developed at that dose, further administration of the same drug is unlikely to produce acceptable sedation unless extremely large doses are employed. It is recommended in the discussion of basic techniques that the inexperienced doctor should terminate the procedure and attempt a different IV technique at a later date.

The doctor who meets one or both of the criteria listed above can, however, administer a second CNS depressant to this patient. The narcotics are an excellent choice for this goal, small doses of narcotics usually providing the additional degree of sedation required for the patient to accept dental treatment and remain comfortable.

Second, a degree of analgesia is provided during painful procedures, or in some cases (barbiturates) the narcotic counterbalances the negative effect of a drug on pain reaction. When used in this regard, a larger dose of narcotic will be desired.

The order in which the antianxiety or sedative hypnotic and narcotic will be administered will depend on the reason for its inclusion in the technique.

Requirement: sedation

In the situation in which the agent from group A (diazepam, midazolam, pentobarbital, or promethazine) has been administered to its maximal recommended dose and the patient still remains unsedated, the addition of the narcotic will aid in providing the necessary sedative effect.

The narcotic will be slowly titrated, the doctor and assistant carefully observing the patient for signs of increased sedation. Titration of the narcotic ceases as soon as the desired sedative level is reached. The depth of sedation achieved in this manner should be no greater than that observed with the basic techniques.

In this first technique, in which the patient's primary requirement is anxiety control, the patient will have received a larger dose of the antianxiety drug and a smaller dose of the narcotic analgesic, for example, diazepam 20 mg and meperidine 10 mg or promethazine 50 mg and morphine 6 mg.

Requirement: analgesia

When the planned dental procedure involves considerable discomfort, such as in oral surgery or periodontal surgery, the benefits of a narcotic

analgesic may be welcome. The primary method of pain control will always be local anesthesia. The addition of IV analgesics will simply help the patient during the procedure should the local anesthetic effect begin to lessen. The nature of the discomfort experienced by the patient will be altered.

When used for this reason the analgesic will be administered first, until one of two things occur: (1) clinically adequate sedation develops or (2) maximal recommended narcotic dose is administered. In most situations the slow administration of the narcotic will *not* produce significant sedation so that the maximal recommended dose is usually administered.

Following the completion of the narcotic administration, if additional sedation is desired, a group A drug may be slowly titrated.

It is obvious that when this technique is employed, the patient will receive a larger dose of the narcotic analgesic and a smaller dose of the antianxiety or sedative hypnotic drug, for example, meperidine 50 mg and diazepam 7 mg or pentazocine 30 mg and promethazine 15 mg.

Some patients are quite sensitive to the CNS-depressant actions of narcotics and will in fact demonstrate adequate sedative effects at a dose below that of the maximum recommended for that agent. Should this occur, titration of the narcotic is ceased when the desired sedative level is reached, no other group A drug is administered intravenously, and treatment is started.

The maximal doses and the recommended dilutions of the group B drugs are presented in Table 26-3.

Techniques

Diazepam or midazolam with narcotic

When diazepam or midazolam is being used as the primary drug for sedation, the most appropriate narcotics to employ are the shorter acting ones: meperidine, alphaprodine, fentanyl, and pentazocine. Duration of sedation will usually not be increased; however, it is possible that clinical recovery at 60 minutes will not be as complete as that seen with diazepam or midazolam administered alone. Use of longer acting narcotics will only delay recovery.

Table 26-3. Group B drugs: doses and dilutions

	Availability (mg/ml)	*Maximal dose (mg)*	*Dilution for use (mg/ml)*
Meperidine	50	50	10
Morphine	10	8	1
Alphaprodine	40 to 60	40	10
Fentanyl	0.05	0.08	0.01
Pentazocine	30	30	10
Nalbuphine	10	10	2
Butorphanol	2	2	0.4

Diazepam or midazolam with narcotic plus anticholinergic

Addition of an anticholinergic is based on the criteria previously discussed. The use of glycopyrrolate is not recommended because of its prolonged duration of action when compared with diazepam or midazolam.

The anticholinergic may be mixed in the same syringe as the narcotic (see the Jorgensen technique for procedure).

Promethazine with narcotic

Because the clinical action of promethazine is somewhat longer than that of diazepam or midazolam, longer acting narcotics may be employed if indicated. Nalbuphine, butorphanol, morphine, meperidine, and pentazocine are recommended. Morphine should be used for procedures requiring very close to or slightly over 2 hours to complete, and meperidine and pentazocine are for those procedures requiring just slightly over 1 hour.

Promethazine with narcotic plus anticholinergic

There is little need for this combination because of the anticholinergic properties of promethazine.

Pentobarbital with narcotic

The administration of pentobarbital intravenously as a sole agent for sedation is rarely justified because of the negative effect of the drug on the patient's response to pain. Patients receiving barbiturates intravenously overreact to painful stimulation. In addition, many patients become quite talkative and will increase their movement in the dental chair following pentobarbital administration.

The administration of a narcotic analgesic therefore is almost mandatory whenever pentobarbital is employed unless, of course, the doctor does not wish to increase the sedative level of the patient any further.

Pentobarbital will only be employed for dental procedures requiring 2 or more hours to com-

plete. Therefore the choice of narcotic is limited to the longer acting ones:

Meperidine (if duration is just 2 hours)
Morphine (for 2 to 4 hours)
Butorphanol (2 to 3 hours)
Nalbuphine (2 to 3 hours)

Pentobarbital with narcotic plus anticholinergic

Addition of an anticholinergic to pentobarbital and a narcotic produces a modification of the Jorgensen technique. Because of the proven reliability of that technique, I recommend its use in place of other possible combinations.

If a drying effect is required, but not amnesia or additional sedation, glycopyrrolate is recommended.

The narcotic analgesic may always be mixed with the anticholinergic medication in the same syringe.

Narcotic with group A drug

In reversing the order of drug administration we are seeking a greater analgesic effect from our drugs. Anxiety reduction is not the primary reason for the IV procedure.

The narcotic and antianxiety or sedative hypnotic agent selected for use should be based on the anticipated duration of the procedure, as was discussed above.

Anticholinergics (group C) may be added to the narcotic syringe if desired.

Table 26-4 illustrates the different doses of group A and B drugs required when administered alone or in combination. These results are from a study carried out by myself in several IV sedation continuing education courses.

When any of these techniques are used, the drugs must always be titrated slowly (1 ml per minute, unless otherwise recommended).

The patient is carefully observed for signs of increased sedation so that oversedation does not occur.

Never combine the narcotic in the same syringe as the group A antianxiety or sedative hypnotic.

OTHER TECHNIQUES

Other techniques of IV sedation are available. I believe that the techniques to be discussed in this section should *not* be employed unless the doctor has completed a minimum of 1 year of training in anesthesiology and is conversant with and able to maintain the airway of the unconscious patient. The depth of sedation achieved in these techniques might be termed *deep sedation* as compared with the significantly lighter levels described in the previous sections. The point at which deep sedation ends and general anesthesia (the loss of consciousness) starts is a grey area to be avoided by all but the most well-trained individuals.

Diazepam with methohexital (Foreman technique)

The combination of diazepam with methohexital, an ultrashort acting barbiturate, has been used with success by many persons, foremost among whom is Peter Foreman of New Zealand.

After the initial administration of diazepam to the baseline level of sedation (see diazepam technique discussion), a dose of from 5 to 10 mg of methohexital is employed whenever unpleasant procedures are to be started. This might include administration of local anesthetics or surgery on osseous structures. The 5 to 10 mg increments of methohexital provide a deepening of sedation (into the grey zone) that lasts for from 5 to 10 minutes.

Foreman has found the technique to be useful in dental procedures requiring 30 to 90 minutes. In his experience the usual dose of drugs administered in a procedure lasting more than 1 hour,

Table 26-4. Average drug doses from 1716 cases

Agent(s)		*Dose (mg)*	
Drug 1	*Drug 2*	*Drug 1*	*Drug 2*
Diazepam	—	12.8	—
Diazepam	Meperidine	19.3	33.0
Meperidine	Diazepam	47.1	8.6
Promethazine	—	41.2	—
Promethazine	Meperidine	48.6	31.1
Meperidine	Promethazine	45.2	21.4

are diazepam 10 to 20 mg and methohexital 50 to 100 mg (in 5 to 10 mg increments). Amnesia is greatly enhanced by addition of the methohexital.

Care must be taken to administer only small increments of methohexital with this technique because larger doses will produce sedation bordering on loss of consciousness, with attendant depression of protective reflexes.

The Berns technique

Joel Berns has developed a technique involving the administration of three drugs, the barbiturate (group A) secobarbital, the narcotic (group B) meperidine, and the barbiturate (group A) methohexital.

Secobarbital is administered first, being slowly titrated to baseline sedation (the dose range being from 25 to 75 mg), followed by 25 mg to 50 mg meperidine. Local anesthesia is administered and the procedure started.

Methohexital in increments of 10 to 20 mg is administered just prior to any traumatic procedure, which may include administration of local anesthesia, or extractions.

The Shane technique

Sylvan Shane, from Maryland, developed a technique, first described in 1966 that he calls "intravenous amnesia." It consists of two components: (1) a verbal component that precedes drug administration, and (2) a drug component that involves the IV administration of alphaprodine, hydroxyzine hydrochloride, atropine, and methohexital, and local anesthesia for pain control.

The verbal component is quite important in this technique. Prior to drug administration the patient is told the following:

1. You will be asleep during the procedure.
2. Prior to falling asleep you will feel the calming effects of the medications.
3. "Pentothal" is being administered.
4. No pain will be felt during the procedure.
5. When the procedure is complete, you will express disbelief and insist that you were never asleep. *(This must be said to the patient before the patient says it to the dentist.)*
6. You will know when the procedure is over for your lips, tongue, and teeth will feel numb. When you feel the numbness, you will know that "something must have happened" and this numbness confirms the fact that the procedure is over.
7. *(The patient is then exposed to the sound of the drill, air blower, and amalgam condenser.)* You will hear these sounds, and they also mean that the procedure is over. These instruments are used to polish, carve, and smooth the fillings, and this done during the hour required for you to awaken sufficiently to get up out of the chair.
8. *(Gauze is placed over the patient's eyes [taped in place].)* The gauze will be over your eyes when you awaken to keep the polishing dust out of your eyes.
9. *(The patient's later response to all of the above is anticipated.)* You will swear that you were never asleep, yet the treatment will be completed and you will feel as though only a minute has passed.

The drugs are then administered as listed in Table 26-5.

Shane recommends combining the alphaprodine, hydroxyzine, and atropine in one syringe; the methohexital being kept in a second syringe.

Following the administration of the drugs in the first syringe to clinical effect, 1 to 2 ml (10 to 20 mg) of methohexital is administered. Local anesthesia of the entire oral cavity (as needed) is obtained.

On completion of local anesthetic administration the patient is told to close the mouth and nothing is said or done for the next 2 minutes.

Table 26-5. Shane technique drug schedule

	*Dose (mg)**		
Drug	*Age 2 to 6 years*	*Age 7 to 18 years*	*Adult*
Alphaprodine	6	7 to 18 (Same as age in years)	18 to 24
Hydroxyzine	25	25 to 50	50
Atropine	0.3	0.4	0.6

*Normal saline is added to dilute the mixture as needed to a total of 5 ml in the syringe.

The dentist then tells the patient that the treatment is completed, all the fillings are done, and the patient may now go home. Of course, the doctor has not even started treatment yet. Patients normally respond to this by saying, "You're fooling me" or "You're kidding."

The doctor counters this by reminding the patient that his mouth is numb, and that he was told previously that when he awakened, he would be numb. The patient will then lie back in the chair and begin sleeping.

At this point the doctor states, "I am going to be polishing your fillings or trimming your bony spicules from the extraction sites." The actual dental procedure is then started.

Shane terms the verbal component of the procedure the "therapeutic lie." He has reported on at least 15,000 sedations without fatality.

The patient during the Shane technique is definitely in the grey zone between deep sedation and general anesthesia. The doctor employing this technique must be well trained in management of this patient.

A factor that severely limits the use of the Shane technique is the recommendation by the manufacturers of hydroxyzine hydrochloride that the drug not be administered intravenously.

SUMMARY

A significant number of techniques of IV sedation have been presented in this chapter. There is absolutely no reason for any one doctor to have all of these procedures available for use in his or her dental practice.

The most rational method of employing these techniques is to start out by working with the basic techniques first. To learn them well will require at least 100 cases of each technique.

The only method of obtaining the knowledge and training in use of these techniques is through dental school undergraduate, postgraduate, and continuing education courses. The safe administration of IV sedation cannot be learned through the reading of a textbook.

Strict adherence to the recommendations for each of the drugs and techniques, without exception, no matter how tempting they might appear, is mandatory. If these simple rules are followed, problems will not occur. A summary of recommended drugs, dosages, and durations is found in Table 26-6.

Table 26-6. Summary of intravenous drug doses, duration, amnesia

Drug	*Mg/ml used*	*Average mg*	*Maximal mg**	*Maximal mg†*	*Duration*	*Amnesia‡ induced*
Group A						
Diazepam	5	12 to 15	20	30	45 minutes	Yes
Midazolam	2.5	2.5 to 7.5	—	—	<45 minutes	Yes
Pentobarbital	50	125 to 175	300	500	2 to 4 hours	Somewhat
Promethazine	10	25 to 35	50	75	1 to 2 hours	Somewhat
Group B						
Meperidine	10	37.5	50	50	<1 hours	No
Morphine	1	5 to 6	8	8	1.5 to 2.5 hours	No
Alphaprodine	10	15 to 20	30	40	30 to 45 minutes	No
Fentanyl	0.01	0.05 to 0.06	0.08	0.08	30 to 45 minutes	No
Pentazocine	10	20	30	30	1 hour	No
Nalbuphine	2	7 to 8	10	10	1.5 to 2 hours	No
Butorphanol	0.4	1.5	2	2	1.5 to 2 hours	No
Group C						
Atropine	0.4	0.4 to 0.6	0.4 to 0.6	0.4 to 0.6	3 to 4 hours	No
Scopolamine	0.3	0.3	0.3	0.3	3 to 4 hours	Yes
Glycopyrrolate	0.1	0.1	0.1	0.2	7 hours	No

*Maximal dose at one titration.
†Maximal total dose at appointment.
‡Amnesic effect when used in maximal dose recommended.

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