Personnel Requirements

- Personnel: a minimum of two individuals
- Dentist qualified to administer the moderate sedation
- At least one additional individual
- Successful completion of a course in Basic Life Support (BLS) for the Healthcare Provider

Patient Evaluation

<table>
<thead>
<tr>
<th>Minimal Sedation</th>
<th>Moderate Sedation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients must be suitably evaluated.</td>
<td>Patients must be suitably evaluated.</td>
</tr>
<tr>
<td>Healthy or medically stable individuals (ASA I, II):</td>
<td>Healthy or medically stable individuals (ASA I, II):</td>
</tr>
<tr>
<td>A review of current medical history and medication use.</td>
<td>A review of current medical history and medication use.</td>
</tr>
<tr>
<td>Patients with significant medical considerations (ASA III, IV):</td>
<td>Patients with significant medical considerations (ASA III, IV):</td>
</tr>
<tr>
<td>May require consultation with their primary care physician or consulting medical specialist.</td>
<td>May require consultation with their primary care physician or consulting medical specialist.</td>
</tr>
</tbody>
</table>

Equipment Requirements

<table>
<thead>
<tr>
<th>Minimal Sedation</th>
<th>Moderate Sedation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive-pressure oxygen delivery system.</td>
<td>Positive-pressure oxygen delivery system.</td>
</tr>
<tr>
<td>When inhalation equipment is used, it must have:</td>
<td>When inhalation equipment is used, it must have:</td>
</tr>
<tr>
<td>A fail-safe system that is appropriately checked and calibrated and</td>
<td>A fail-safe system that is appropriately checked and calibrated and</td>
</tr>
<tr>
<td>A functioning device that provides the delivery of less than 30% oxygen or</td>
<td>A functioning device that provides the delivery of less than 30% oxygen or</td>
</tr>
<tr>
<td>An appropriately calibrated and functioning in-line oxygen analyzer with audible alarm</td>
<td>An appropriately calibrated and functioning in-line oxygen analyzer with audible alarm</td>
</tr>
<tr>
<td>An appropriate scavenging system must be available if gases other than oxygen or air are used</td>
<td>An appropriate scavenging system must be available if gases other than oxygen or air are used</td>
</tr>
</tbody>
</table>
Equipment Requirements

Moderate Sedation

- The equipment necessary to establish intravenous access must be available.

Monitoring and Documentation

Minimal Sedation

- A dentist, or at the dentist's direction, an appropriately trained individual, must remain in the operatory during active dental treatment to monitor the patient continuously until the patient meets the criteria for discharge to the recovery area.
- The appropriately trained individual must be familiar with monitoring techniques and equipment.
- Monitoring must include:
  - Arterial blood pressure
  - Heart rate
  - Oxygen saturation
  - End-tidal carbon dioxide

Moderate Sedation

- A qualified dentist must remain in the operatory room to monitor the patient continuously until the patient meets the criteria for recovery.
- When active treatment concludes and the patient recovers to a minimally sedated level a qualified auxiliary may be directed by the dentist to remain with the patient and continue to monitor them until they are discharged from the facility.
Monitoring and Documentation

The dentist must not leave the facility until the patient meets the criteria for discharge and is discharged from the facility.

Monitoring must include:

**Oxygenation**
- Color of mucosa, skin, or blood must be continually monitored.
- Oxygenation saturation by pulse oximetry may be clinically useful and should be considered.

**Ventilation**
- The dentist and/or appropriately trained individual must verify respiratory continuity.
- The dentist and/or appropriately trained individual must verify respiratory continuity.

Robert M. Peskin, DDS
adopted by the ADA House of Delegates
October 22, 2012

ADA Guidelines for the Use of Sedation and General Anesthesia by Dentists
Monitoring and Documentation

Minimal Sedation

- Circulation
  - Blood pressure and heart rate should be evaluated pre-operatively, post-operatively, and intraoperatively as necessary

Moderate Sedation

- Circulation
  - The dentist must continually evaluate blood pressure and heart rate
  - Continuous ECG monitoring of patients with significant cardiovascular disease should be considered.

Robert M. Peskin, DDS
adopted by the ADA House of Delegates
October 22, 2012

ADA Guidelines for the Use of Sedation and General Anesthesia by Dentists

Monitoring

- Routine
- Specialized
- Extensive
Monitoring

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Sphygmomanometry

- Human blood pressure monitoring
- Routine
- Non-Invasive Blood Pressure (NIBP)

Guidelines for Blood Pressure Cuff
- Cuff width should be 20% wider than limb diameter
- Cuff width should be 2/3 length of upper arm, and length 1/3 greater than arm circumference

Korotkoff sounds (turbulent flow)
- Systolic—when sounds first appear
- Diastolic—when sounds muffle
- Mean arterial pressure
- Oscillometry

Custom Cuff™ Technology
Improved Detection of Hypotension by Automated Noninvasive Blood Pressure Monitoring

J Clin Monit 1991;7:168-171

Automated NIBP Monitoring

<table>
<thead>
<tr>
<th>Year</th>
<th>1987</th>
<th>1989</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood pressure monitoring</td>
<td>auscultation</td>
<td>automated</td>
</tr>
<tr>
<td>Anesthetic records reviewed</td>
<td>1861</td>
<td>1861</td>
</tr>
<tr>
<td>Incidence of detected hypotension</td>
<td>2.4%</td>
<td>5.2%</td>
</tr>
</tbody>
</table>

Limitations
- May cause peripheral nerve injury
- Slow response time
- Requires regular heart rate and/or rhythm
- Requires a reasonable blood pressure

Tips and Tricks
- If obese patients can use forearm or calf
- If unable to hear Korotkoff sounds, use return of pulse via pulse oximeter
- To evaluate for technical error, compare cuff heart rate to ECG
Automated NIBP Monitoring

Monitoring of Oxygenation

- Pulse Oximetry Technology
- Optical plethysmography
- Spectrophotometry

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Arterial O2 Content:

\[ O_2 \text{ bound to Hb} + O_2 \text{ dissolved in plasma} = (1.34)(\%\text{ saturation}) + 0.003(P_{aO_2}) \]

no real-time monitor clinically meaningless
Pulse Oximetry Technology

Detection of Pulsatile Flow

The pulse oximeter is comprised of a light-emitting diode that measures the absorption of specific wavelengths of light that differ between oxygenated and deoxygenated hemoglobin.

Light at a wavelength of 660 nm is selectively absorbed by oxygenated hemoglobin and light at a wavelength of 940 nm is absorbed by deoxygenated hemoglobin.
Pulse Oximetry Technology

Detection of Pulsatile Flow

Plethysmographic Comparison of Light Absorption

- The ratio of light absorptions is calculated by the pulse oximeter according to an internal computer algorithm to give a reading of a patient's arterial hemoglobin oxygen saturation (SpO2).

- Readings are dependent on pulsatile blood flow; measurements are taken at the point of maximum intensity of the waveform. This allows the monitor to also compute and display pulse rate.

- The probe is normally placed on a finger or toe, but sensors are also available for the nose, ear, and cheek.

- Regardless of placement, readings may be altered by physiologic and technical factors.

Anything that would cause a low flow state in the peripheral vascular beds may interfere with accurate measurement:

- Hypotension
- Hypothermia
- Vasodilation

Ambient lighting can interfere with the wavelengths detected by the pulse oximeter, and patients who are agitated or shivering can cause motion artifact and probe displacement.

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Pulse Oximetry Technology

- Dark or metallic nail polish as well as acrylic finger nails might also produce spurious readings

Assumptions

- All that pulses is arteriolar blood
- All light passes through pulsatile bed
- There is adequate Hb concentration
- There are no extraneous dyes present
## Case Study

52 ASA I & II patients
- Median age: 32.29 ± 14.13 years
- Mean weight: 63.50 ± 14.79 kg

### Sedation Score

<table>
<thead>
<tr>
<th>Sedation Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Awake and alert</td>
</tr>
<tr>
<td>1</td>
<td>Awake but calm</td>
</tr>
<tr>
<td>2</td>
<td>Eyes closed but responds to name</td>
</tr>
<tr>
<td>3</td>
<td>Asleep but wakes when tapped lightly</td>
</tr>
<tr>
<td>4</td>
<td>Requires vigorous stimulation to be awakened</td>
</tr>
</tbody>
</table>

## Methodology

- All patients breathed room air at the onset
- Pre-sedation baseline readings were recorded
- Sedation began with midazolam
- 1–3 mg initial dose
- 1 mg reported boluses until sedation score = II

## Results

<table>
<thead>
<tr>
<th>Sedation Score</th>
<th>Desaturation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.4% desaturated</td>
</tr>
<tr>
<td>2</td>
<td>4.4% desaturated</td>
</tr>
<tr>
<td>3</td>
<td>14.7% desaturated</td>
</tr>
<tr>
<td>4</td>
<td>40.0% desaturated</td>
</tr>
</tbody>
</table>
Is Sedation Without Desaturation Possible?

The price of sedation is desaturation.

Progressive depth of sedation is accompanied by progressive desaturation.

Desaturation significant enough to make routine oxygen supplementation advisable.

Robert M. Peskin, DDS

Oxyhemoglobin Dissociation Curve

- per cent saturation of hemoglobin
- demonstrates progressive
- % O₂ bound to Hb as blood PaO₂
- arterial blood: 95 mm Hg 97%
- venous blood: 40 mm Hg 75%

“A pulse oximeter is a sentry on the cliff of desaturation.”

Air

- 79% nitrogen (N₂)
- 21% oxygen (O₂)
- atmospheric pressure at sea level = 760 mm Hg
- PN₂ (partial pressure of nitrogen) = 600 mm Hg
- PO₂ (partial pressure of oxygen) = 160 mm Hg
Oxyhemoglobin Dissociation Curve

A drop in oxygen saturation signals a compromise in ventilation that has already occurred.

Motion Artifact

- Can result from:
  - Shivering
  - Seizures
  - Restlessness
  - Anesthetic induction/emergence

Solution - place probe at alternative site:
- Ear
- Nose
- Forehead
Low Perfusion

- Can result from
  - Intense vasoconstriction
  - Severe peripheral vascular disease
  - Hypothermia
  - Hypovolemia

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Auscultation of Breath Sounds

- Pre-Cordial Stethoscope
- Pre-Tracheal Stethoscope
- Tethered
- Wired
- Wireless

Robert M. Peskin, DDS
Electrocardiograph (ECG/EKG)

- Routine
- Aid in dysrhythmia detection
- Indicator of myocardial ischemia

- Indicated where CO₂ can rise significantly
- Risk of ectopy
- Risk of premature ventricular contractions (PVC’s)
- Risk of unexplained tachycardia
1. Is there a P wave?
2. Is there a normal-looking QRS complex?
3. What is the relationship between P waves and the QRS complexes?

ECG Analysis

4. Is the rate fast or slow?
5. Are the atrial and ventricular rates the same?

6. P to P wave and R to R wave intervals:
   - Are they regular or irregular?
   - If irregular, are they consistent or irregularly irregular?

7. Is there a P wave before each ventricular complex?
8. Does the P wave follow the QRS complex?
9. Are P waves and QRS complexes identical and normal in configuration?
10. Are the P-R and S-T intervals within normal limits?
11. How is the dysrhythmia significant clinically?
Normal Sinus Rhythm

Capnography

- Monitoring of the concentration or partial pressure of CO₂ in respiratory gases.
- A monitoring tool for use during anaesthesia and intensive care
- Presented as a graph of expiratory CO₂ plotted vs.
  - time, or
  - expired volume
- Useful as monitor of respiratory rate and activity

Capnography

Exhalation  Inspiration  Exhalation
Capnography

- A→B: Exhalation of dead space
- B→C: Exhalation of lower airway
- C→D: Exhalation of alveoli
- point D: End-Tidal CO2
- D→: Inspiration

Nasal Cannula

- Portex First Breath® nasal oxygen cannula
- gas monitoring line (3.0 m)
- female luer connector
- 2.1 m tubing
- oxygen adapter

Fresh gas output
Capnography

Nasal Hood

Porter "Brown Mask"

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