

## Day Stay Anesthesia in Dentistry

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There are multiple reasons for the shift in location of surgical procedures. Technical developments, including advances in surgical techniques, particularly with minimally invasive surgery and new anesthetic agents, have increased the types of cases that can be performed on an outpatient basis. Changing economic conditions and the increasing desire of patients to return home early have all altered the demand for ambulatory surgery.

In the last decade, day stay anesthesia has been blessed with the introduction of several agents that have tremendously affected the quality of care we can provide to our patients. Those agents that have been most successful in their effect on our daily practice (enflurane, isoflurane, midazolam, propofol, and vecuronium) have provided some combination of following qualities to our patients: more rapid recovery, easy titration to individual patient's need, and fewer side effects.

In today's health care environment, there is increasing pressure for improved efficiency, outcome, and safety in anesthetic practice. This article reviews an usefulness of each anesthetic agents for day stay anesthesia in dentistry, which include intravenous agents, inhalation agents, analgesic agents, muscle relaxants and premedicant drugs.

### Patient Preparation

Optimal preoperative preparation of outpatients will

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This article presented in the 4th Japan-USA-Korea International Symposium on Dental Anesthesiology On Oct. 8, 2000.

probably make day stay surgery safer and more acceptable. Outpatients used to be denied pharmacologic anxiolysis because of delaying recovery, however, with short-acting benzodiazepine (temazepam, midazolam), sedation, amnesia, and anxiolysis can be provided without a clinically significant delay in recovery. And non-pharmacologic approaches, such as preoperative education, might be useful and preinductional administration of intravenous sedative-anxiolytic drugs (especially with 1–3 mg midazolam) have assumed. And preventive measures may be taken to reduce common postoperative side effects, nausea & vomiting (N/V) and pain. For prevention of aspiration, we can recommend NPO after midnight, however clear liquid can be safely ingested up to 2 hrs before surgery. And we can administer metoclopramide or H<sub>2</sub>-antagonists in high risk patient for nausea & vomiting.

### Methods & Agents for Day Stay Anesthesia

Day stay surgery may potentially be conducted under general, regional or local anesthesia. Although the choice of technique depends upon both surgical and patient factors, general anesthesia remains the most popular technique. General anesthesia can be conducted by inhalation anesthesia with sole volatile agents, total intravenous anesthesia and balanced anesthesia using combination of intravenous or local anesthesia under light inhalation anesthesia. In monitored anesthesia care (MAC), sedation may be added to local anesthetic- based techniques.

Properties of an ideal anesthetics for day stay anesthesia can be summarized as followings. Provides for a rapid and smooth onset of effect, and produces sedation, amnesia, analgesia and muscle relaxation, and lack of intraoperative

side effects, such as cardiovascular instability or respiratory depression, and possesses a rapid recovery profile without postoperative side effects, especially nausea & pain. And provides residual analgesia during the early postoperative period, and finally represents a cost-effective alternative to currently used drugs.

### 1. Intravenous anesthetics (Table 1)

Thiopental has long been the gold standard agent for intravenous induction. However, thiopental can impair fine motor skills for several hours and produce a hang over sensation even after short outpatient procedures. Methohexital permits a significantly faster awakening and earlier recovery, but its use is associated with excitatory side effects. Etomidate has also been used for induction and maintenance of general anesthesia for short outpatient procedure because of its favorable effects on cardiovascular and respiratory system. However, use of etomidate was associated with a high incidence of pain on injection, myoclonic movements and postoperative N/V. Induction time of midazolam is prolonged compared with thiopental, so midazolam is not popular for induction, and has side

effects of residual sedation and amnesia. Flumazenil is highly effective in reversing residual midazolam induced sedation and amnesia. Propofol has recently become the intravenous induction agent of choice for day stay anesthesia. Its use is associated with rapid recovery and a very low incidence of postoperative N/V. We can prevent injection pain by concomitant injection of small dose lidocaine. Although the search for improved intravenous anesthetics is continuing, none of the newer agent, including etlanolone, appear to have as favorable a recovery profile as propofol.

### 2. Inhalation anesthetics (Table 2)

In spite of the increased interest in intravenous anesthetic technique, inhalation agents remain the most popular drugs for maintenance of general anesthesia. The newer halogenated ether compound (desflurane, sevoflurane) have significantly lower blood: gas solubility, thereby permitting a more rapid onset and termination. And this less-soluble volatile agents provide a greater degree of intraoperative hemodynamic stability.

In comparison between enflurane and isoflurane for

Table 1. Comparison of Intravenous Anesthetics for Day Stay Anesthesia

Drug name	Dose (mg/kg)	Onset of action	Recovery profile	Side effects
Thiopental	3-6	Rapid	Immed.	Drowsiness ("hang over")
Methohexital	1.5-3	Rapid	Rapid	Injection pain; excitatory activity
Etomidate	0.15-0.3	Rapid	Immed.	Injection pain; myoclonus; N/V
Ketamine	0.75-1.5	Immed.	Immed.	CV stimulation; emergence reactions
Midazolam	0.1-0.2	Slow	Slow	Residual sedation; amnesia
Propofol	1.5-2.5	Rapid	Rapid	Injection pain; CV depression

Table 2. Comparison of Inhaled Anesthetics for Days Stay Anesthesia

Drug name	Inspired Conc. (%)	Onset of action	Recovery profile	Side effects
Enflurane	0.75-1.5	Intermed.	Intermed.	Shivering
Isoflurane	0.5-1	Intermed.	Intermed.	Coughing
Desflurane	3-6	Rapid	v. rapid	Coughing; tachycardia
Sevoflurane	1-2	Rapid	Rapid	± metabolites/breakdown products
Nitrous oxide	50-70	v. rapid	v. rapid	± nausea/emetis

ambulatory anesthesia, some investigators have found only minor differences, while other investigators have reported the use of enflurane is associated with more rapid recovery and lower postoperative side effects than isoflurane.

Desflurane has recently become available and has rapidly gained popularity for maintenance of day stay anesthesia. Desflurane possesses the lowest blood: gas solubility of all volatile anesthetics (0.42) and is associated with the most rapid awakening after outpatient surgery. Because of the vapor pressure of desflurane is so close to atmospheric pressure in room temperature (681 mmHg), the standard vaporizer design does not provide adequate temperature control and accuracy of flow, and so need specialized vaporizer for desflurane, Tec 6 vaporizer. FDA has made two recommendations regarding carbon monoxide poisoning, 1) All soda-lime that has been dormant in anesthesia machine for more than 24hrs should be changed and dated, and 2) the anesthesia machine should be flushed continuously with 100% oxygen for at least 1 min before the first case of the day. Cardiovascular effects of desflurane can be divided into two parts: the direct effects of the anesthetic, and a usually transient response involving sympathetic nervous system activation.

Use of sevoflurane is associated with faster awakening times and fewer postoperative side effects than isoflurane. And because of non-irritation to airway, sevoflurane can also be used for mask induction as an alternative intravenous agents. Sevoflurane appears to be unstable under both in vitro and in vivo condition. The in vitro degradation involves a reaction of sevoflurane with carbon dioxide absorbent to various olefin compounds, especially compound A has generated the greatest concern because of its

toxicity in various animal models. However, despite extensive clinical testing, several studies have failed to demonstrate any hepatic or renal dysfunction, even at very low flows of fresh gas. Compared with propofol, sevoflurane showed more rapid emergence and orientation in several studies. In addition, sevoflurane, unlike desflurane, possessed a cardiovascular profile that is remarkably stable and does not activate the sympathetic nervous system.

### 3. Adjunctive agents

Adjunctive agents are often administered during general anesthesia to produce intraoperative amnesia, improve hemodynamic stability, decrease the volatile anesthetic requirements, and reduce postoperative side effects such as N/V and pain. Midazolam's sedative, anxiolytic and amnesic properties make it a popular adjunct during the preinduction period. And recently, there has been increasing interest in the use of sympatholytic drugs to improve intraoperative hemodynamic stability. And also clonidine and esmolol have both anesthetic and analgesic-sparing effect during day stay surgery.

And we can add short acting opioid analgesics (Table 3) as an adjuvants for day stay anesthesia. Fentanyl and its new analogs (sufentanil, alfentanil, and remifentanil) have potent anesthetic sparing actions, improve intraoperative hemodynamic stability and anesthetic condition, and can provide a more rapid emergence from general anesthesia. When newer inhalation anesthetics (sevoflurane, desflurane) are combined with a low dose remifentanil infusion (0.075–0.1  $\mu\text{g}/\text{kg}/\text{min}$ ), emergence from anesthesia is extremely rapid and facilitating the fast-tracking process. But, unfortunately, these compounds also

**Table 3.** Comparison of Opioid Analgesics for Day Stay Anesthesia

Drug name	Dose ( $\mu\text{g}/\text{kg}$ )	Onset of action	Recovery profile	Side effects
Morphine	50–100	Slow	Slow	Sedation; N/V, ileus
Fentanyl	1–2	Intermed.	Intermed.	Sedation; N/V
Sufentanil	0.1–0.2	Rapid	Intermed.	Sedation; N/V
Alfentanil	7.5–1.5	v. rapid	Rapid	N/V; rigidity
Remifentanil	0.5–1.0	v. rapid	v. rapid	N/V; rigidity

Table 4. Comparison of Muscle Relaxants for Day Stay Anesthesia

Drug name	Dose (mg/kg)	Onset of block	Duration of block	Side effects
Succinylcholine	0.75 - 1.25	v. rapid	v. short	Phase II block, myalgias
Atracurium	0.3 - 0.6	Intermed.	Intermed.	Histamine release
Mivacurium	0.15 - 0.25	Intermed.	Short	Histamine release
Vecuronium	0.06 - 0.12	Intermed.	Intermed.	Variable recovery
Cisatracurium	0.1 - 0.2	Intermed.	Intermed.	None
Rocuronium	0.4 - 0.8	Rapid	Intermed.	Variable recovery

contribute to increasing the incidence of postoperative emesis.

#### 4. Muscle relaxants (Table 4)

The muscle relaxants are also an essential component of a balanced anesthetic technique. Compared to the long-acting relaxants, the more widespread use of the intermediate-acting non-depolarizing muscle relaxants (e.g., atracurium and vecuronium) has minimized problems related to inadequate reversal after short day-case procedures. However, the availability of a shorter-acting non-depolarizing muscle relaxant, mivacurium, has decreased the need for reversal agents even after brief ambulatory procedures. Avoidance of neostigmine-glycopyrrolate will result in a decreased incidence of postoperative nausea and vomiting in the recovery room. Although the new vecuronium-derivative, rocuronium, has an onset of action which is reported to be similar to succinylcholine, there is still a need for a more rapid and shorter-acting non-depolarizing muscle relaxant which would facilitate tracheal intubation, while providing for a predictable recovery without the need for reversal drugs.

#### Postoperative Analgesia

Rapid recovery may result in emergence-agitation, and probably related to rapid awakening to postoperative pain. So it's a very important postoperative pain management perioperatively.

Following day stay surgery, pain should be controllable with conventional oral analgesics, such as acetaminophen

with codeine, before patients are discharged. However, potent rapid-acting opioids, such as fentanyl, alfentanil and sufentanil, are commonly used in the early recovery period. The primary concern regarding the use of opioids in day stay surgery relates to their possible side effect of postoperative nausea and vomiting. Recently there has been an increased use of potent non-steroidal antiinflammatory drugs, such as ibuprofen, diclofenac and ketorolac. Use of local anesthetic techniques for intraoperative analgesia or as adjuncts to general anesthesia, can provide supplement analgesia during the early postoperative period. Simple wound infiltration or peripheral and regional nerve blockade has been shown to improve postoperative analgesia following a variety of surgical procedures.

Future growth in variety of surgical procedures which can be performed on day stay basis, will require further improvements to provide effective postoperative pain control. One method which has been proved as effective modality in all kinds of surgery is preemptive analgesia. We can prevent noxious surgical stimulation with preoperative administration of analgesics including NMDA antagonists or preincisional local anesthesia. Another is the concept of subcutaneous PCA (patient control analgesia), which has been

Used for managing pain requiring parenteral analgesics outside the hospital.

#### Summary

Day stay anesthesia should include: rapid smooth onset;

rapid recovery without residual side effects; absence of adverse effects (N/V); and providing postoperative analgesia. General anesthesia with multi-modalities (inhalation, intravenous and local anesthesia) may be preferable in day stay surgery.

Future studies on new drugs and techniques for day stay anesthesia need comparing the increased cost of newer treatments with the potential financial savings resulting from earlier hospital discharge, reduced supplemental drugs, and earlier return to work.

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