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Abstract

There is very little information about the practice of sedation in Japan. Despite the remarkable advances in dentistry, fear and anxiety continue to be significant deterrents for seeking dental services. Most dental procedures can fortunately be undertaken with the aid of sedation. A comprehensive survey of all the dental schools in Japan was carried out to determine what sedation practices were used in Japan. All 29 dental schools in Japan possessed a dedicated department of anesthesiology at the time of this survey. The survey attempted to determine the specific sedation methods (techniques, routes of administration, and agents used in sedation) as well as practices (monitoring, fasting, location, education, and fees involved in sedation). The results indicate that there was a broad range in sedation practices. The Japanese Dental Society of Anesthesiology may wish to examine the findings of this study and may wish to formulate guidelines appropriate for the practice of sedation in Japan. Others may also wish to compare their own practices with those of Japan.
Sedation in Japanese Dental Schools

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There is very little information about the practice of sedation in Japan. Despite the remarkable advances in dentistry, fear and anxiety continue to be significant deterrents for seeking dental services. Most dental procedures can fortunately be undertaken with the aid of sedation. A comprehensive survey of all the dental schools in Japan was carried out to determine what sedation practices were used in Japan. All 29 dental schools in Japan possessed a dedicated department of anesthesiology at the time of this survey. The survey attempted to determine the specific sedation methods (techniques, routes of administration, and agents used in sedation) as well as practices (monitoring, fasting, location, education, and fees involved in sedation). The results indicate that there was a broad range in sedation practices. The Japanese Dental Society of Anesthesiology may wish to examine the findings of this study and may wish to formulate guidelines appropriate for the practice of sedation in Japan. Others may also wish to compare their own practices with those of Japan.

Key Words: Dental anesthesiaology; Dental sedation; Dental anxiety; Dental education; Dental pain control.

There is very little information about the practice of sedation in Japan4 and no information in the English literature. All 29 dental schools in Japan had a dedicated department of anesthesiaology at the time this survey was conducted. A comprehensive survey of all Japanese dental school anesthesiaology departments was carried out toward the end of 1999 to determine what sedation methods and practices were used in Japan and whether there was variability or consistency in these practices. All aspects of pain and anxiety control in Japan are primarily managed by specialist dentist anesthesiologists or those in training. It was hoped that the results of these findings would lead to information of what sedation practices occur in Japanese dental schools and whether there is consistency of instruction in this important dental procedure.

Without effective anxiety and pain control, numerous dental procedures would either involve undue pain and/or patient apprehension or be virtually impossible to perform. In addition, both anxiety and pain control techniques are often essential for the special patients, young children, and physically challenged. In this group of patients and analgesia are essential. Quality care, especially in developed countries, is also a concern that determines whether or not dental care is needed.

It has been reported that over 88% of sedation surveyed in Japan reported dental fear classified as having high fear. Almost 7% of people surveyed reported experiencing dental fear during treatment. The fear of dental treatment was over 50% of the sample.2 Patients who seek oral health care more regularly could improve their oral health.5 As specialists in pain control, dental anesthesiologists are in a position to address these concerns.

Inhalational sedation (IHS) with nitrous oxide, allows rapid onset of action, and simultaneously supplies oxygen. This allows for effective sedation as a sole agent in induction to intravenous sedation, which compromises the patient's safety.6 There is a documented death directly attributable...
IHS (≥20% O₂) in dentistry, hence its record of safety is superior to the use of local anesthetic alone.

IVS is an extremely effective, predictable, and safe method for anxiety control, particularly after the introduction of modern monitoring such as oximetry. The use of anxiolytic, sedative, and anesthetic techniques by appropriately trained dentists in the dental office and other settings continues to have a long history and remarkable record of safety.

METHODS

A survey was sent to all 29 departments of anesthesia in Japanese dental schools toward the end of 1999. The questionnaire consisted of 30 main questions and was in English.

RESULTS

The response rate was 24/29 (82%). Three surveys were completed in Japanese. As multiple agents and techniques were used by many departments, the total percentages may exceed 100%. The results are as follows:

- Routine IVS technique: benzodiazepine boluses, 25%; continuous propofol infusion, 25%; benzodiazepine continuous infusion, 13%; propofol infusion with bolus administration, 4%; propofol bolus administration only, 4%; combination of the listed techniques, 29% (none of these techniques were patient controlled).

- Medications used during IVS grouped according to reported use. As sedatives (note that some analgesics were reported as sedatives): midazolam, 96%; propofol, 75%; diazepam, 42%; flunitrazepam, 25%; ketamine, 21%; pentazocine, 17%; thiopentone, 4%; hydroxyzine, 4%; and fentanyl, 4%. As analgesics: pentazocine, 21%; fentanyl, 13%; butorphanol, 8%; and ketamine, 8%. Number of sedative agents available: 1, 5%; 2, 18%; 3, 36%; 4, 5%; 5, 27%; and 6, 9%.

- Medication used for intraoperative analgesia (not including local anesthesia): pentazocine, 67%; fentanyl, 25%; butorphanol, 21%; flurbiprofen/ketamine, 13%; pethidine, 4%; and etizocine, 4%. Number of intraoperative analgesics available: 1, 22%; 2, 52%; 3, 9%; and none, 17%.

- Postoperative analgesics used: yes, 83%; no, 17%. Postoperative analgesics used by anesthetist or surgeon: diclofenac (suppository), 17%; diclofenac (orally), 13%; flurbiprofen, 13%; fentanyl, 4%; acetaminophen (orally or rectally), 4%; loxoprofen sodium (orally), 4%. If postoperative analgesics were used, the proportion given by anesthetist: yes, 83%.

- Opioids used: yes, 43%; no, 57%. If opioids were not used: complicated procedure, 31%; respiratory depression, 15%; psychiatric effects, 8%; multiple drugs, 8%; local anesthetic sufficient, 8%; shocks, 8%; not familiar with, 8%; and no reason, 8%. Of the reasons given for not using opioids: 54%; and none, 8%.

- Anti-sialogogue: no, 74%; yes, 26%. 100% used atropine, and 33% used atropine, polamine.

- Oxygen used routinely as part of IVS: 33%; 75% used nasal cannula. Flow rate 10-30 min.

- Nitrous oxide in oxygen used with IVS: 29%; sometimes, 13%. No potent inhalant used with IVS. Concentration % of N₂O: <30-58%; 30-25%; >30-17%.

- Percentage of sedation patients using conduction, 15.5%; range, 0-50%.

- Proportion of patients receiving consciousness, 83 ± 22%, range 30-100%; deep sedation, 22%, range, 0-70%.

- Proportion of IVS patients that are ambulatory: 60 ± 35%, range 0-100%.

- Written preoperative information for patients: yes, 71%, no, 29%.

- Written postoperative information for patients: yes, 54%; no, 46%.

- Consent required before intravenous sedation: yes, 100%. Consent was oral, 83%; written, 33%.

- Length of food fasting for IVS: 5.5 hours, range 0-12 hours.

- Length of liquid fasting for IVS: 5.5 hours, range 0-9 hours.

- Monitors for IVS: pulse oximetry, 100%; ECG, 100%; electrocardiogram (ECG) rate, 88%; respiratory rate, 21%; Paco₂, 4%; stethoscope, 4%. Number used: none, 0%; 1, 0%; 2, 0%; 3, 42%; 4, 13%; 6, 4%.

- Monitors for inhalational sedation (IF): 87%; BP, 91%; ECG, 83%; heart rate, 87%; Paco₂, 9%. Number used: none, 4%; 1, 0%; 2, 0%; 3, 50%; 4, 8%. Monitors for IVS same for IHS: 50%.

- IVS used in the operating theater: yes, 71%; IVS used out of the operating theater: 29%.

- Types of dentistry IVS used for: intraoral, 100%; extroral surgery, 91%; general.
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- 83%; periodontics, 83%; implant surgery, 92%; other, 21%.
- IVS used based on ASA classification: ASA I, 100%; ASA II, 96%; ASA III, 67%; ASA IV, 4%.
- Youngest age IVS is provided: 6.5 ± 4.8 years, range 0–16 years. Sedation method used for children same as adults; yes, 83%.
- Tests routinely requested for ASA I patients for IVS (not for the surgery): hematology studies, 53%; interview and examination, 24%; ECG (12 lead), 19%; BP, 14%; respiratory rate, 14%; heart rate, 9%; urine analysis, 9%; SpO2, 5%; internal medicine consult, 5%; spirometry, 5%; chest radiograph, 5%; depth respiration, 5%; Cornell Medical Index, 5%. Number of tests used: none, 45%; 1, 15%; 2, 15%; 3, 20%; 5, 5%.
- IVS services provided by any dental anesthesia department member to private clinics outside the hospital: no, 32%; yes, 68%. If yes, type of clinic: general clinic, 80%; specialist clinic, 60%.
- Does department provide education regarding resuscitation to general dental practitioners: yes, 87%.
- Does department provide education and training regarding IVS to general dental practitioners: no, 71%. If no, is it important to provide such education and training: yes, 76%.
- IVS services used enough in private general dental practices: yes, 30%; no, 70%. Reasons why not: general dentists do not have training or experience or knowledge, 44%; cost or remuneration (not covered by insurance), 25%; lack equipment, 12%; difficult/impossible/dangerous by general dental practitioner, 6%; lack of staff, 6%; not enough dental anesthetists for the amount of general practices, 6%.
- Should there be guidelines for IVS sedation in private general practices: yes, 96%. If yes, should the Japanese Society for Dental Anesthesiology be responsible for preparing these guidelines: yes, 95%.
- Fees charged for IVS: ¥17,256 ± 21,690; ¥0–50,000, no charge, 4%; receive insurance fee, 8%; cost of drugs, 8%; time-dependent, 4% (100.00 JPY = 0.95 US$).
- Fees charged for IHS: ¥1582.25 ± 1684, ¥0–4358; no charge, 13%; receive insurance fee, 13%; cost of drugs, 13%.

DISCUSSION

The response rate of 82% represents an excellent return for a mailed questionnaire. The results should provide a reasonably accurate assessment of sedation practices in Japan around the year 2000.

Both intravenous and inhaled sedation were viewed in this study with the major focus of agents and techniques will depend on the status of the patient, age, length, and type of procedure, depth of sedation and analgesia, and the preference of the practitioner as well as local support available. One technique may serve the needs of all patients, and many techniques will decrease the likelihood of side effects.

The most common IVS techniques used were benzodiazepines or propofol delivered intravenously to conscious patients. After benzodiazepines, the next most common sedative was ketamine. It appears that 59% of respondents have 3 or fewer sedative agents available.

It may be that many of these could only 2 benzodiazepines and propofol or benzodiazepine, propofol, and ketamine hence the dominance of the single drug reported in the survey. Interestingly, opioid analgesia, fentanyl and benzyl ether, were also listed as used by some departments. It is presumed that these are used in combination with benzodiazepines, rather than as opioid-only sedation, or the only barbiturate listed as being used.

Thiopentone has a steep dose-response curve, with no sedation observed until a dose of approximately 5 mg/kg is given. A “balanced” technique for instance, like benzodiazepines that produce analgesia can be combined with opioids, will not allow a “balanced” technique to be used in terms of both safety and cost, be it for the public interest.

The use of patient-controlled sedation as a part of any routine IVS technique is a safe practice of sedation will probably allow patients to control their own sedation up to a certain point. This allows the mean dose of drug to be decreased, therefore allowing more control over his or her treatment.

Mixed agonist-antagonist opioids such as fentanyl and clonidine are among the most commonly used analgesic agents. Propofol is a superior mixed opioid agonist-antagonist analgesic compared to other agents.
In comparison to pentazocine with fewer adverse effects, particularly dysphoric effects. Although butorphanol has been reported to increase cardiovascular workload, this is highly unlikely at commonly used IVS doses. Eptazocine is another opioid agonist-antagonist, but there are few human reports in the English literature and it appears that the agent is not available outside of Japan for comparison. There is a common misconception that these drugs produce less respiratory depression than conventional mu agonist opioids. Although a ceiling effect for respiratory depression does exist for the agonist-antagonist group, at commonly used dosages in IVS, respiratory depression, either alone or combined with other sedative agents, is comparable to mu agonist agents. Their popularity is likely to be due to less bureaucracy involved in their use in comparison to the pure opioids.

Postoperative analgesia, other than local anesthesia, is usually a nonsteroidal anti-inflammatory agent. Dental anesthesiologists were more likely than surgeons to administer opioids for postoperative pain control. Postoperative analgesic plans for ambulatory patients are important to prevent unanticipated hospital admissions, and NSAIDs, compared with opioids, are less likely to induce postoperative nausea and vomiting. The literature supports the efficacy of 2 or more analgesic techniques (including nonpharmacologic methods) used in combination for the control of perioperative pain, especially when different sites and/or mechanisms of action are involved and/or when synergy of effect is achieved. In addition, the literature indicates that multimodal approaches are associated with side effects no greater than those resulting from single analgesic techniques for perioperative pain management.

The main reason given for the lack of use of opioids was that they involve “complicated procedures”; hence a matter of convenience and practicality was at issue, rather opioids being clinically contraindicated or related to patient factors and other adverse effects of opioid analgesics such as nausea and vomiting or mental clouding.

Interestingly, 1.7% of respondents indicated that they do not use postoperative analgesics. It is unclear whether they are unavailable or not used in dental procedures that do not normally require postoperative analgesics.

Anticholinergics are very useful in the practice of dentistry for reducing salivary secretions and atropine, in particular to correct vagally induced bradycardia. Atropine and scopolamine can, however, increase the risk of anticholinergic syndrome with attendant postoperative delirium. Glycopyrrolate is a potent anticholinergic that does not cross the blood-brain barrier and is less likely to produce unwanted central nervous system (CNS) effects. Other adjunctive agents such as hydroxyzine, a potent antihistaminic drug that has actions, can be particularly useful in the gestion. Antiemetic agents as such were not reported to be used.

Oxygen must be available during IVS as it is easy and inexpensive to administer; however, respondents do not use oxygen routinely. Therapy with nasal cannulae is generally desirable, and three quarters of the respondents realized this method of oxygen delivery. Pressure increased by breathing supplemental oxygen than room oxygen, as these patients are at risk of oxygen desaturation.

Nitrous oxide continues to be an important part of pain and anxiety control, with an inhaled concentration of N₂O being euganalogic to 10–15 mg of morphine. Nitrous oxide is reported to be between 20 and 40%, but any concentration may vary anywhere between 5 and 70%. Anxiety followed by syncope can occur, prompting IV cannulation. Premedication for IHS may be a more effective technique for anxiety associated with intubation. IHS may be a more effective technique for prevention some episodes of syncope. The addition of N₂O in oxygen when used alone has not been shown to significantly alter end-tidal CO₂ and oxygenation. The addition of 30% nitrous oxide to propofol for oral surgery sedation has been shown to decrease the dose of propofol, thereby hastening patient recovery. Nitrous oxide is nonirritating and has been used successfully in dentistry; however, it was not used in this survey. Nitrous oxide is not active agent reportedly used for IHS.

Preoperative information and counseling is a patient satisfaction and reduces anxiety. In some institutions, preoperative instructions were provided by the regular dentist. Presumably all departments provide instructions. Increasing the quantity of preoperative information significantly increases patient satisfaction without increasing analgesic cost. Approximately half (54%) of the departments offer written postoperative instructions. The reason why will accompany the patient at discharge and have written instructions. Half of the respondents obtained written consent before IVS. In religious societies, such as the United States, preoperative information is not formally required. A body such as the Dental Anesthesiology may wish to prepare standard forms as consent forms and preoperative information.

A wide range of fasting times was reported, although it is known that 95% of clear liquids are emptied...
stomach of healthy, ambulatory patients in 2 hours or less. Especially for light IVS or IHS, there appears to be little advantage in withholding clear fluids for more than 2 hours before surgery, which is especially helpful in preventing dehydration in pediatric patients and patients who may not be able to eat or drink for some time because of the nature of their surgery or long-acting local anesthesia of the oral cavity. It has been shown that prolonged fluid fasting before anesthesia actually increases the volume and decreases the pH of gastric juice. The volume of liquid ingested is less important than the type of liquid ingested. Preoperative fasting of solids between 4 and 8 hours increases patient comfort/satisfaction and reduces adverse outcomes. Fried, fatty foods or meat may prolong gastric emptying time compared with lighter meals. There is insufficient information to show that any fasting decreases the incidence of adverse outcomes during dental sedation or anesthesia.

Monitoring practice also appears somewhat variable among departments of anesthesiology. Verbal communication was not mentioned as a part of monitoring the patient, but for many patients this is a simple and effective method to determine level of consciousness and appropriate anxiolysis. Other patient observations such as ptosis of the eyelid, slurred speech, or level of muscular relaxation were also not mentioned. No doubt this is routinely undertaken but not mentioned as monitoring was interpreted as technology-based. The percentage of monitors used to measure heart rate was less than the percentage of monitors such as pulse oximetry, blood pressure, and ECG, which invariably measure heart rate as well. It is presumed that the difference is due to people reporting less dedicated monitors solely for measuring heart rate.

Pulse oximetry, heart rate, ECG (which is considered optional for ASA I patients), continuous blood pressure, and pretracheal/cordial stethoscope are all required for IVS. PaCO₂ is optional as well as temperature measurement during long procedures but is not essential.

Capnography may provide an advantage for use in children, especially when supplemental oxygen is given; however, this has not been proven to be more useful than pulse oximetry alone. In regard to capnography, there are a number of disadvantages to its use in the dental setting. Scavenging is required when nitrous oxide sedation is being used with a nasal hood; hence sampling directly from a nasal hood has been proven to be inefficient and may confuse the observer. If the patient is mouth breathing, then this type of monitoring is totally ineffective. However, conducted nose by dental drills and other equipment may compromise the efficacy of monitoring by stethoscope; therefore, capnography may be beneficial. Ventilatory function is monitored by observation and/or auscultation.

ECG monitoring is recommended in significant cardiovascular disease such as dysrhythmias. Vital signs should be recorded before IVS, intraoperatively, and immediately before discharge. These measurements will depend on the amount of medications given, the procedure, and the condition of the patient to indicate the need or effectiveness of intraoperative monitoring during IVS.

Although the majority of respondents ASA III patients, 33% would not. The thing to do so was not given. Antianxiety allows for a less stressful encounter for dental treatment and likely improves high-risk patients with active ischemia. Similarly, geriatric patient’s oral surgery was managed in the dental office with IVS complications.

Patients between the ages of 1 and 17 years with mental or developmental delay represent most procedures, including those for anesthesiologists in particular are in the actively and safely offer younger patients and anxiety control. There is no difference in the expected future dental behavior or anxiety experience sedation compared with general anesthesia for dental treatment at a young age.

Although this survey was most interesting, sedation techniques, deep sedation was used in 17% of departments, and general anesthesia cases were provided by 60% of departments with sedation and local anesthesia shown to be superior to same-day general anesthesia and the cost savings are obvious. The reason to return promptly to their home environment is higher general anesthesia—related oral surgery is approximately 1:100 IVS. Of course, some patients, such as and physically challenged, pre-cooperative patients undergoing extensive procedures sedation.

The costs of laboratory tests are high and the future indicates that they are inferior to physical examination. Often when abnormalities are detected, they are not pursued. Blood pressure, ECG, and pulse oximetry are adequate for preoperative testing of II patients provided a detailed medica- the need for focused anesthetic physical examinations and no additional data are deemed necessary. Blood pressure and sinuses readings are maintained.
dural laboratory testing should be guided by the patient's medical condition and the chance that the results will affect their sedation management. Hence it is almost always unnecessary for ASA I patients.

The majority of dental schools provide education regarding resuscitation, but they do not provide training for IVS. Most did, however, state that IVS training for general dental practitioners was important. Seventy percent of respondents stated that IVS services were not being used enough in private general practices. Stakeholders such as the Japanese Dental Society of Anesthesiology, Japanese Dental Association, universities, and the Ministry of Health and Welfare may wish to further investigate this situation.

Training to competency in conscious sedation techniques may be acquired at the predoctoral, graduate, postgraduate, or continuing education level. Postgraduate clinical training (internship) is becoming more common and in the future will become compulsory in Japan. This may be a suitable program for the training of appropriate pain and anxiety control techniques. Various countries, for example Australia, United Kingdom, and the United States have developed postgraduate programs in sedation and pain control. As pain control forms a fundamental part of general dentistry, its place in the undergraduate course may need to be reviewed. The American Dental Association (ADA) has guidelines for teaching the comprehensive control of anxiety and pain to the dental student. Education and training is also required for ancillary staff (dental nurses). Such courses with clinical practice are available in other countries.

Currently there are no guidelines for IVS in private Japanese general dental practices. The ADA has a policy statement entitled 'The Use of Conscious Sedation, Deep Sedation, and General Anesthesia in Dentistry and the Guidelines for the Use of Conscious Sedation, Deep Sedation, and General Anesthesia for Dentists,' which may be useful as an initial guide.

There was a large range in fees charged for IVS, and the fees for IHS seem to be very low compared with other dental services. It is important that the national health insurance system supports pain and anxiety control as it does any other form of treatment, particularly if it allows the patient to complete a dental procedure that they might otherwise avoid. There are also the questions of subsequent psychological trauma and quality of life. Through appropriate marketing and education, patients may be willing to pay on a private basis if they can be provided with comfortable and pain-free treatment.

The results of this study indicate that there is a wide range of practices associated with sedation in Japan. The information gained may be useful for both those within and outside of Japan. Not all patients are adequately managed with simple conscious sedation; the full extent of pain and anxiety control is particularly in airway management. Much of Japanese dental anesthesiologists, there has been a single fatality due to the direct result of general anesthetic administered in Japan. This indicates that all forms of pain control are well managed in Japan, which is a model for the rest of the world. The reasons for this may be multiple and complex but reflect the high standards of training, practice, and search for standards in the specialty.

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