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General anesthesia and dental sedation in patients with special needs: why, when and how. A clinical guide for dental practitioners

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ABSTRACT

Aim This review aims to provide an overview of the methods of anaesthesia in dentistry, and to frame the patients on whom this practice is needed, in order to provide a clinical guide for practitioners.

Methods The drafting of the article involved dentists, anaesthetists and pharmacologists to try to address the topic from every possible point of view on a clinical sight. Therefore, the scientific literature and field experience of the writers were taken into account. Not only different methods were explored, but also drugs and their indications and contraindications for patients. Moreover, the importance of a psychologically valid and patient-focused approach was highlighted. Also, a focus on Covid-19 precautions to be implemented before and during dental procedures was carried out.

Results A protocol was set to identify patients who require general anesthesia and clinical guide was developed for clinicians on practice as well as an operational scheme for the treatment of patients with special needs.

Conclusion Multidisciplinary collaboration of healthcare professionals is essential as well as constant update to improve patient well-being, this is the more so when treating special needs patients.

KEYWORDS Anesthesia; Sedation; Dentistry; Special needs patients; Pharmacology; Covid-19.

INTRODUCTION

Patients with behavior management problems (BMP), young age and unpleasant previous experience, can be uncooperative and require behavioral techniques for their management. In some cases, standard techniques are not enough to complete a dental treatment and this can lead to worsening of oral diseases. This happens when patients, both children and adults, are classified as odontophobics or are affected by medical pathological conditions such as autism spectrum disorder (ASD) or attention deficit hyperactivity disorder (ADHD). Therefore, dental treatment may require sedation.

Odontophobia is an irrational and overwhelming fear of dentistry. Odontophobics feel abnormal anxiety not only for dental procedures but also when visiting the dentist for preventive care.

Considering ADHD, defined as a childhood disorder causing impulsivity, inattention and hyperactivity, dental treatments cannot be performed because it is difficult, frequently impossible, to keep the patient still. These subjects might suddenly move and jeopardize the operator's work, preventing him/her from performing a correct treatment, prodice a risk of injury for both clinician and patient.

Autism spectrum disorder (ASD) is a heterogeneous neurodevelopment disorder characterized by attention-deficit and hyperactivity disorder, anxiety, social communication/interaction deficit, disorders of sleep and feeding and restrictive, repetitive patterns of behavior (52).

Odontophobia and ASD are closely related phenomena, since they describe the same behavioral pattern when patients get in touch with the dentist and the dental office. As a consequence, dental treatment and injections become impossible.

Patients with special needs are more likely to develop dental problems (43), because lack of trust in dentists precludes not only therapies but also prevention. Often, dental fear or behavior management problems are associated with increased caries and oral diseases, for example if dentine caries is untreated it will engender pain and necrosis which can only be solved by surgery or canal treatment. De facto, compliant children have a lower incidence of dental disease (95).

Using the International Classification of Functioning, Disability and Health - Child and Youth version (ICF-CY), Norderyd et al., stated that the level of caries

experience in children with complex disabilities is strongly correlated with experience of dental general anesthesia, (116). Children who struggle in their interpersonal interactions should receive both dental and medical treatments coordinated under the same GA in order to avoid additional costs and unnecessary quantities of drugs (97). However, this theme will not be faced in this article.

Poor oral health, delineated by caries and periodontal disease, also has a negative impact on quality of life, because it involves chewing dysfunctions, due to missing or aching teeth, and major aesthetic discomfort, especially for adult phobic patient who are aware of their non-aesthetic smile.

According to "Oral Sedation in the Dental Office" (Sebastiani, al.), in the United States more or less 30% of patients need dental care but refuse to undergo dental visit and 18% of adults would be visited more frequently if they were under the effect of a drug to make them relax. Thus, sedation and general anesthesia are comfortable and successful pharmaceutical interventions. Moreover, they reduce the level of anxiety and increase pain threshold, depending on sedation's depth (66, 71).

For these reasons, complete functional and aesthetic rehabilitation of the patient's oral cavity can be carried out in one multi-treatment session under sedation or general anaesthesia. All dental treatments will be concentrated in one session to avoid mental stress in the patient and repeatedly subject him/her to drug administration. Nevertheless, multi-treatments or a single longer and more complex therapy, can be performed under anesthesia or sedation also in patients who have not dental phobia or BMP, because they have the advantage of saving time, money and avoiding the excessive intake of drugs, especially antibiotics.

The purpose of this review is to highlight which clinical conditions require a modality of intervention and approach that facilitates or, in some cases, allows, the achievement of therapies. The goal is to frame an operational scheme to be followed, within the limits of the approach studied for each individual special needs patient, from a pharmacological, clinical-dental and psychological point of view. The intention is to give patients the possibility to receive adequate therapies, to relieve them from pain and/or avoiding the evolution of pathologies into more severe ones. All this gained by atraumatic treatments, from both the physical and, especially, psychological perspective. On the other hand, this article aims to provide guidance for the clinician in deciding which anesthetic technique is most suitable for each case.

METHODS

The review bases its considerations on the scientific literature, and on the multidisciplinary approach between dentists, anesthesiologists and pharmacologists to try to address the topic from every possible point of view. Therefore, the scientific literature and field experience of the writers were taken into account. Not only different methods were analyzed, but also drugs and their indications and contraindications for patients, including a focus on COVID-19, showing the precautions to be implemented before and during dental procedures. The result is an overview of the methods of anaesthesia in dentistry, helping to frame patients on whom this practice is needed in order to provide clinical guidelines for practitioners.

CLINICAL GUIDELINES FOR PRACTITIONERS

General anesthesia and intravenous sedation

Intravenous sedation is applied when psychological techniques are not sufficient to finalize dental treatment. This method is recommended in patients with dental phobia or medical condition in order to reduce or eliminate fear and anxiety during oral/dental surgical treatment.

Indications (79) are the following.

1 Patients with dental phobia.
2 Patients in whom vasovagal reflex, hyperventilation syndrome, panic disorder, and so on are likely to develop from dental treatment.
3 Patients with a strong vomiting reflex or abnormal gag reflex.
4 Patients who require stabilization of intraoperative circulatory dynamics (patients with hypertension, heart disease, etc).
5 Subjects with disabilities who require sedation: patients with Parkinson's disease who have severe tremor or patients with Alzheimer (these patients are uncooperative and clench their mouth tenaciously).

Contraindications (79) are the following.

1 Patients in early stages of pregnancy
2 Patients with myasthenia gravis: they can be treated under general anesthesia but paying particular attention to the dosage of drugs.

There are different levels of sedation, divided as follows. Conscious sedation: A medically controlled state of depressed consciousness that allows protective reflexes to be maintained, retains the patient's ability to maintain a patent airway independently and continuously, and permits appropriate response by the patient to physical stimulation or verbal command. Although cognitive function and coordination may be modestly impaired, ventilatory and cardiovascular functions are unaffected. Type of sedative agent selected, route of administration and dose modify the duration and the type of effect. Many sedative agents can also induce general anaesthesia in higher doses; sometimes, the difference in dosage can be very modest, and it varies from patient to patient. For example, benzodiazepines are tranquilizers but at

Score	Definition	Description	What to do
4	Combative	Clearly combative, violent, imminent danger to oneself or staff	Patient's observation
3	Very agitated	Aggressive, evident risk of removing catheters or tubes	Patient's observation
2	Agitated	Frequent aimless movements, maladjustment to mechanical ventilation	Patient's observation
1	Restless	Anxious but without aggressive and vigorous movements	Patient's observation
0	Awake and calm	Includes periods of physiological sleep	Patient's observation
-1	Soporose	Not fully awake, opens arms and eyes to verbal stimulation, maintains eye contact >10 seconds	Verbal stimulation
-2	Mildly sedated	Brief awakenings to verbal stimulation, eye contact < 10 seconds	Verbal stimulation
-3	Moderately sedated	Movement or eye opening to verbal stimulation (but without eye contact)	Verbal stimulation
-4	Deep sedation	Non-response to verbal stimulation, movement or eye opening to physical stimulation	Verbal stimulation
-5	Not awake	No response to tactile/painful stimulation	Verbal stimulation

TABLE 1 RASS score.

high doses they become hypnotics; on the contrary propofol is a hypnotic but at a lower dosage it acts as a tranquilizer.

Moderate sedation: A medically controlled depression of consciousness during which patients respond purposefully to verbal commands, alone or with light tactile stimulation. Spontaneous ventilation is kept and cardiovascular function does not need to be impaired.

Deep sedation: A medically controlled state of depressed consciousness or unconsciousness during which patients cannot be easily aroused but respond purposefully following repeated or painful stimulation. It may be accompanied by a partial loss of protective reflexes, and the ability to independently maintain ventilatory function may be impaired. Cardiovascular function is maintained. This state and its risks may be indistinguishable from those of general anesthesia. It may be associated with complications, such as airway obstruction and aspiration.

General anesthesia: A medically controlled state of unconsciousness during which patients are not arousable, even by painful stimulation. It is accompanied by a complete loss of protective reflexes, including the inability to maintain ventilatory function. Patients often require assistance in maintaining a patent airway, and positive pressure ventilation may be required because of depressed spontaneous ventilation or drug-induced depression of neuromuscular function. Cardiovascular function is maintained.

RASS (Richmond Agitation Sedation Scale) is used to describe the level of sedation and agitation in patients (Table 1).

Venous access is achieved through cannulation by transcutaneous puncture of superficial, palpable, rectilinear and patent veins. It is essential to have a venous access that is secure and stable over time. The puncture sites are various, it can be the dorsum of the hand, radial side of the wrist joint, antecubital fossa, and so on (Fig. 1). It is preferable to take venous access on the dorsum of the hand or on the radial side of the wrist joint, because these are areas in which, in the event of patient movement, the drug infusion would not be hindered. A large blood vessel should be chosen to avoid vascular pain or postoperative phlebitis, however a smaller vein would be fine as long as it is taken in one of those areas. In children, the best locations to take venous access by cannulating the butterfly needle, in addition to hands, are the distal veins of the back of the foot (Fig. 2). A programmable syringe pump for anesthesia should be recommended in order to obtain a softer, more fluid and constant anesthetic plateau, on which it is possible to

FIG. 1 Wrist venous access.

FIG. 2 Foot venous access.

FIG. 3 Programmable syringe pump for anesthesia.

FIG. 4 Nasal probes.

intervene with small corrections (Fig. 3).
There are no highly reliable studies that have examined the length of treatment time, quality of sedation, and incidence of complications during intravenous sedation. It is preferable that the duration of treatment under intravenous sedation is less than 2 hours, because it is easier to manage anesthesia. However, it can last 3-4 hours when needed.
Being sedation and general anesthesia a continuum, there is not always the possibility of predicting how an individual patient will respond. Therefore, the anesthetist whose goal is to produce a specific level of sedation should be capable of diagnosing and managing the physiological consequences, if eventually the patient's level of sedation is deeper than initially intended.
Nonoperating room anesthesia (NORA) refers to administration of sedation/anesthesia outside the operating room to patients undergoing painful or uncomfortable procedures (9). NORA in dental field is not allowed in Italy, therefore legally it cannot be performed even if it would be clinically possible.
Anesthesiologists must have great experience and the correct equipment, to deal with the increased risk of adverse events that NORA brings, such as desaturation, apnea, cardiac alterations, hypothermia and so on. In most cases, critical events are due to operator error or lack of rescue systems. The anesthesiologist must be sure that staff is adequately trained to assist in anesthesia as well as cardiopulmonary resuscitation, because they can cause severe complications in NORA.
It is customary to think that conscious, moderate, deep sedation and general anesthesia are four different anesthetic techniques. In reality, it is a purely conceptual ad theoretical subdivision because they correspond to different levels consciousness and anesthesia. If we compared anesthesia to a building with several floors, the attic would correspond to consciousness. The deeper you go down the floors, the deeper the anesthesia is. This is until the floor where spontaneous ventilation ceases and intubation is required. The drugs administered are the same but depending on the dose, injection speed and concentration, the patient passes from one level of anesthesia to another.
General anesthesia in the collective imagination is associated with endotracheal intubation, but actually it is not. General anesthesia must be associated with a total loss of consciousness and the maintenance of more or less reflexes. Thus the patient may be subjected to general anesthesia but be on a "floor" in which spontaneous ventilation is maintained or on a lower one in which it is not. In fact, the difficulty lies in achieving a respiratory balance in a patient under general anesthesia while maintaining spontaneous ventilation with minimal oxygen support. If anesthesia goes too deep, rhinotracheal intubation, the lightening of the state of anesthesia or orotracheal intubation become necessary.
In dentistry, orotracheal intubation cannot be done

because the operating field and the site of intubation coincide. It is possible only if the dental operation does not concern the entire oral cavity but only one side. Therefore, nasotracheal intubation is preferred. However, spontaneous ventilation under general anesthesia can also be maintained with nasal probes that allow minimally invasive intubation while remaining in spontaneous breathing with low oxygen flow (from 2L/min to maximum 6L/min). This procedure allows to increase the percentage of saturation, and therefore deepen the anesthesia while maintaining excellent oxygen saturation. Nasal probes are normally confined to nostrils. Yet, if they are cut and inserted up to nasopharynx, 10 cm of dead respiratory space that is not used, would be eliminated (Fig. 4). Dead space represents the volume of ventilated air that does not participate in gas exchange. Nasal probes should be applied slowly and with vaseline, because if patients have turbinate hypertrophy, excessive force can cause turbinate hemorrhage.
Anesthesia, performed in this way, requires continuous observation and attention to predict the organism's response during induction, maintenance and awakening. The extreme difficulty consists in finding the ventilatory balance without causing a ventilatory depression that would irreparably stop the dental intervention because it would force the anesthetist to occupy the operating field and mechanically ventilate the patient.
The advantages of this technique are: (1) Less mechanical trauma, (2) less equipment, (3) cheaper method, (4) general anesthesia that allows to work well on the patient, by maintaining respiratory activity and spontaneous ventilation.

PHARMACOLOGICAL APPROACH

Midazolam

Midazolam is a short acting imidazobenzodiazepine with a rapid onset of action. It causes central nervous system depression and conciliates sedation, anterograde amnesia, hypnosis, and has central myorelaxant, sedative and anxiolytic effects (120), thanks to his affinity to inhibitory GABA receptors (121). It increases frequency in the opening of chloride channel by GABA, enhances membrane's hyperpolarization. Nonetheless, it does not mediate an analgesic effect (32), which can be obtained with other classes of drugs.
Depending on the dose, it can provoke modest side effects such as paradoxical reactions (agitation, excitation and aggressivity), diplopia, hiccups, loss of coordination and major ones like breathing depression. Allergic reactions are inexistent. Blood pressure, heart rate and blood oxygen saturation might register a slight decrease.
Benzodiazepine and other drugs, such as opioids and propofol, have synergic effects; this means they can be associated in order to raise sedative and analgesic effects.
Considering its long half-life, it is often employed with a high dosage as an adjuvant of general anaesthesia, in order to reduce anaesthetic drug's dose. This technique is named "Monitored Anesthetic Care" (MAC). Premedication before anesthesia requires 0.1-0.3 mg/kg IV of Midazolam, then followed by propofol that induces moderate/deep sedation (bispectral index values from 70 to 80) and ketamine for analgesic effect. The only disadvantage of benzodiazepine in inducing anaesthesia is delay in awakening.
In pediatric dentistry, the recommended dose is 0.5 mg per 1 kg of body weight, 30 minutes before inducing anaesthesia. However, dose and age can modify the speed of onset of clinical effects. Lower doses are correlated to higher behavior score (15, 19, 31, 67, 73).
Oral administration is the most common one for conscious sedation of children, because it does not cause anxiety due to the sight of a needle. The bitter taste of the drug, in that case, is often covered by a sweet syrup (120,122). Midazolam can also be administered intranasally or rectally (120).
Simultaneous intake of hypnotics, anxiolytics, antidepressants, antipsychotics, antiepileptics, antihistamines, opioids, clonidine and alcohol can enhance the effect.
Flumazenil (8-15 µ/kg) is the antidote that can stop benzodiazepine-induced anaesthesia and adverse effects when they occur (123). The antagonistic effect of flumazenil is rapid, and its efficacy on sedation is excellent. The elimination half-life after intravenous injection is about 50 minutes, and the effect duration is short (20 minutes). If the use of flumazenil when awakening is insufficient or slow, or if respiratory depression is protracted, a higher dose of this drug may be administered. The possibility of using a selective antagonist improves the safety of this drug. Seizure may occur in epileptic patients taking regularly oral benzodiazepine, however, it has been reported that patients with severe mental and physical disabilities who received up to 0.5 mg of flumazenil do not experience convulsions.

Propofol

Propofol is an intravenous anaesthetic agent. It is used to induce general anaesthesia (1-2.5 mg/kg) as an intravenous bolus; doses are lower in elderly patients, or in those with previous cardiovascular conditions or pre-medicated with benzodiazepines or opioids. Children, contrariwise, need higher doses: 2.5-3.5 mg/kg. It is vital to calculate exact quantities in order to prevent hemodynamic events. Since it can be administered continuously, IV Propofol also helps maintaining anaesthesia, in association with inhalational agents and opioids, or in a total intravenous technique exclusively with opioids. Doses range between 3-8 µg/mL, but effects are obtained by intravenous infusion of 100-200 µg/kg/min, when

associated with nitrous oxide and opioids.
Conscious sedation in Monitored Anesthetic Care (MAC) is achieved with a plasmatic concentration of 1-2 µg/mL, gained by continuous infusion of 25-75 µg/kg/min.
It may cause allergic reaction because of its formulation with associated non-pharmacological agents which help it gain higher hydrosolubility.
Due to its high plasma clearance, awakening is better and faster than midazolam. It has a context-sensitive half-time, which means its half-life is a function of the infusion duration; it seems to be very short even after prolonged infusion.
It shows hypnotic properties, it depresses CNS and it is proved to be an anticonvulsant agent, so it can be used on epileptic patients. Among drugs adopted to induce anaesthesia, propofol generates the higher decrease of systemic blood pressure and marked bradycardia.
In doses for anaesthesia induction, propofol produces apnea; in doses for anaesthesia maintaining, it reduces pulmonary ventilation and breathing frequency. Moreover, it inhibits hypoxic and hypercapnic reflexes.
For those reasons, and because it has a low therapeutic index, this medication must be used uniquely by health workers capable of managing respiratory emergencies.

Midazolam vs propofol

According to a study reported in "Practice Guidelines for Intravenous Conscious Sedation in Dentistry" (2017 edition) (79):

- midazolam produces a stronger amnesic effect than propofol;
- physiological and psychomotor functions recovered faster with propofol than midazolam. however, in recent years, propofol alone or in combination with low dose of benzodiazepine has brought prompt recovery after sedation;
- patients treated with midazolam or propofol showed same ability to hold water in their mouth;
- propofol monotherapy or benzodiazepine in combination with propofol had a better reflex control in a moderate or minimal sedative state.

Ketamine

Ketamine is NMDA antagonist, with a rapid onset of action. It is a powerful analgesic agent that induces a state of 'dissociative anaesthesia', during which patients remain with open eyes.
When administered as a single drug, it reduces amnestic effect compared to other medications and maintains respiratory function.
Blood pressure and heart rate increase when used in monotherapy. Cardiovascular effects may be reduced through association with benzodiazepine, opioids and inhalational agents.
Patients may have hallucinations, fear, confusion and euphoria upon awakening, but those effects seem to be reduced in children, because they are the result of experience. Vomiting is very frequent but cannot be treated with antiemetics.
Ketamine has various methods of administration: intravenous, intramuscular, intranasal (33), oral, rectal and epidural. Complications may be prevented by the associated intravenous use of atropine.
The dosage of ketamine for induction of anaesthesia is 1-2 mg/kg IV or 4-6 mg/kg IM. General anaesthesia can be maintained with ketamine in continuous infusion (15/45 µg/kg/min) in association with nitrous oxide (50-70%) or with ketamine as single drug (30-90 µg/kg/min). Intravenous bolus of ketamine in low doses (0.2-0.8 mg/kg) may be used in loco-regional anaesthesia, when further analgesic effect is needed. The infusion of sub anaesthetic doses (3-5 µg/kg/min) during general anaesthesia or in the initial postoperative period may be useful to produce analgesia or to reduce the development of tolerance or hyperalgesia due to opioids.

Dexmedetomidine

Dexmedetomidine is the pharmacologically active dextroisomer of medetomidine and has a selective α2-adrenergic agonism. It attenuates sympathetic effects during surgery. It is mainly used in intensive care because it is infused with syringe pump and thus allows to keep an endotracheal tube in depth.
It is indicated to induce sedation before anaesthesia but can also be used as a short-term sedative due to its analgesic, hypnotic and anxiolytic properties, that help reduce required doses of opioids, needed otherwise for pain control. Effects of dexmetedomidine can be arrested by α2 antagonist drugs, while are enhanced by other sedative-hypnotic medications.
When administered intravenously, dexmetedomidine reduces cardiac frequency, peripheral vascular resistance, and, as a consequence, systemic blood pressure. Cases of serious bradycardia are reported, consequent to an uncontested vagal stimulation. Dexmetedomidine also slightly reduces breathing frequency, that can worsen during sedation.
Three systematic reviews reported that dexmedetomidine is effective for procedural distress in children (33). It is stated that the use of intravenous sedation in managing uncooperative children is more effective with dexmedetomidine than with ketamine.
Previous heart conditions must be investigated because of its potential adverse effect, and the use of this drug must be carefully evaluated with respect to the use of a higher sedation technique (57).
The association of dexmedetomidine and midazolam helps decrease unexpected patient movement during dental surgery (36).

Fentanyl citrate

Fentanyl citrate belongs to the category of opioid analgesics and anaesthetics and accomplishes its effect through its strong agonism on µ receptors.

It is used in premedication (0.1 mg), for any type of anaesthesia (even local), in the postoperative course, and during the operation itself.
It has considerable antimuscarinic properties, that limit its use in tachycardic patients; high doses of fentanyl may induce chest and laryngeal stiffness, which makes its employment allowed only to qualified personnel. Its association with hypnotic agents, such as benzodiazepines, may help prevent postoperative memories.
Dosage must be set considering age, body weight, physical state, medical conditions, use of other medicines and type of surgery and anaesthesia.
Routes of administration are intramuscular 0.1-0.2 mg (2-4 ml), preferred in premedication, analgesia in the postoperative course and pain therapy in general, and intravenous 0.4-0.8 mg, preferred during surgery.

Anti-inflammatory drugs

Glucocorticoids drastically reduce the manifestations of inflammation, due to their marked effects on the concentration, distribution and function of peripheral leukocytes, and their suppressive effects on inflammatory cytokines and chemokines, as well as on other inflammatory mediators. They cause vasoconstriction when applied directly to the skin, possibly by inhibiting the degranulation of tissue mast cells and reduce capillary permeability by reducing the amount of histamine released by basophils and mast cells. Synthetic corticosteroids are, in most cases, rapidly and completely absorbed when administered orally. It is not common to detect severe side effects even at fairly high doses.
They are used as anti-inflammatory drugs, antiemetics and anti-edema drugs. Intravenous cortisone is used only in asthmatic patients, in heavy smokers or when dental surgery is performed.
Cortisone can be associated to chlorphenamine which is an antihistamine. The primary pathophysiological mechanism in the release of histamine from mast cells and basophils is on an immunological basis. These cells, if sensitized by IgE antibodies bound to their plasma membranes, degrade explosively when exposed to a suitable antigen. Degradation leads to the release of histamine, that is a mediator of immediate allergic reactions (type I).
The undesirable effects observed after release of endogenous histamine, as well as those due to the administration of histamine, are dose dependent. Skin redness, hypotension, tachycardia, headache, skin wheals, bronchoconstriction and gastrointestinal disorders are reported.
The effects of histamine released in the body can be controlled in various ways. Physiological antagonists, especially adrenaline, perform opposite actions on smooth muscle to those of histamine, but act on different receptors. This is clinically important, because an injection of adrenaline can save life in the case of systemic anaphylaxis and in other conditions in which a massive release of histamine and other mediators occurs.
Receptor antagonists are another way to reduce histamine-mediated responses. H1 antihistamine agents are often the first drugs used to prevent allergic reactions.
Zirtec, cetirizine dihydrochloride, oral tablets are recommended every morning for 7 days, one week before the operation if the patient has serious allergic diseases. The patient will then take, the night before surgery, chlorphenamine, and on the day of the operation, cortisone associated to chlorphenamine.

Antiemetics

Antiemetic drugs are administered to prevent vomiting, which is one of the most common side effects caused by anesthesia. Among these we find the following drugs.
Metoclopramide is a dopaminergic D-receptor antagonist. It blocks the D receptors in the "trigger" zone of the bulb (postrema area) and this action results in powerful anti-nausea and antiemetic effects. It is used for the prophylaxis and treatment of vomiting. The most common side effects are affecting the central nervous system. Nervousness, drowsiness or insomnia, anxiety and agitation are found in 10-20% of patients, especially in the elderly. Extrapyramidal (dystonia, akathisia, parkinsonian syndrome) due to blockade of central dopaminergic receptors occur in 25% of patients treated in acute high doses and in 5% of patients receiving long-term treatment.
Ondansetron is a selective antagonist for 5-HT receptors. It has high antiemetic properties, through the blocking of peripheral 5-HT receptors, present on the peripheral endings in the intestine of vagal and spinal extrinsic afferent neurons and, in part, of central 5-HT receptors, located in the vomiting center and in the "trigger" zone. It is increasingly used to prevent or treat postoperative nausea and vomiting, as the use of other antiemetic agents is limited by side effects or other restrictions. It has a short plasma elimination and can be administered once daily either orally or intravenously. The reduction of its dosage may be necessary in patients with hepatic insufficiency.
Butyrophenones also have antiemetic properties attributable to the blocking of dopaminergic receptors both central (in the chemoreceptor area, CTZ, of the bulb) and peripheral (receptors present in the stomach). The most widely used agent is droperidol, which can be administered intramuscularly or intravenously. At antiemetic doses, droperidol is very sedating. It is used for postoperative nausea and vomiting.
Dexamethasone also has antiemetic properties, but this mechanism has not been fully explained. It enhances the efficacy of 5-HT receptor antagonists in profiling both acute and delayed nausea and vomiting in patients undergoing highly hematogenous protocols.

Local anaesthetic agents

The type of local anesthetic, the presence or absence of a vasoconstrictor and the dose depend on the patient's weight: the greater the weight the higher the dose. The amount of local anesthetic to be administered depends on the type of intervention but there is no maximum dose because the drug is absorbed into the bloodstream. Anesthetics with vasoconstrictor should be used with caution in patients with heart diseases.

General adverse effects

Detailed pharmacological anamnesis is vital to ensure a safe sedation, because of potential interactions among drugs administered during procedures and substances that patients might have previously taken.

It is important to document the quantity and concentration of inspired oxygen during procedures. The duration of administration of inhalation sedatives needs to be calculated in advance, in order to have under precise control drugs dosage (ie, mg/kg). In case of obesity, drug doses are lower than what expected from the patient's weight (90).

When medications are infused by a programmable pump, dose/kg per time must be always double-checked.

If the patient needs supplemental oxygen before undergoing therapies, similar quantity of oxygen must be administered afterwards too.

Medications with a long half-life may cause a delay in patient's return to awakeness, or even put them at risk of re-sedation (5, 12, 26, 82). Moreover, if the anamnesis showed abnormal multiorgan medical conditions, patients should be kept in a step-down observation area before discharge from medical supervision (37).

Central nervous system depression required to achieve sedation can cause the following.

1 Respiratory complications, such as hypoxia, respiratory depression, cough and aspiration pneumonia.
2 Cardiovascular complications, such as hypertension/hypotension and tachycardia/bradycardia.
3 Other complications like nausea/vomiting, agitation, vascular pain/phlebitis and anaphylaxis.

It is responsibility of medical team prevent those risks or treat them if necessary. In order to avoid collateral effects, maximum allowable safe dosage (eg, mg/kg) must be calculated prior to administration, and practitioner must carefully aspirate to avoid direct injection into a blood vessel in the vascular tissues (48).

Drugs interactions

Local anaesthetic drugs administered in highest recommended doses can cause a summation effect with sedatives or opioids, causing enhanced sedative effects, cardiac depression and excitation or depression of the central nervous system (1, 3, 10, 11, 18, 29, 37, 63, 64, 75, 85, 94, 96, 101, 108, 112, 113).

Benzodiazepines such as midazolam can prevent neurotoxicity if used as premedication.

Increased duration of drug's effect and altered blood drug concentration may occur when cytochrome P450-mediated metabolism is altered. This may happen with associated use of herbal medicines, such as ginger, ginseng, garlic, St John's wort, ginkgo, or drugs, like erythromycin, cimetidine, and others (27, 38, 41, 49, 51, 76, 100-103, 106). A result could be prolonged sedation with the use of Midazolam or other medications metabolized by the same enzyme systems.

Kava and valerian both modulate γ-aminobutyric acid neurotransmission and cause sedative effects (38, 50, 55, 56, 62).

OPERATIVE SCHEME

It is necessary to follow a precise scheme in order to submit patients to a safe sedation. Clinical conditions must be carefully evaluated, so that an appropriate procedure, drugs with well-known pharmacodynamics and pharmacokinetics effects, fitting sized airway equipment and venous access can be selected.

Intraoperative monitoring must be easily performed, and medical staff must be well trained in recovery care (32). This is crucial because of the risks that may occur in sedation, such as respiratory depression, impaired airway patency, apnea, loss of the patient's protective airway reflexes, and cardiovascular instability (46).

History taking

First of all, patient's health must be investigated by the dentist and the sedation team. They should document, during history taking, baseline status and whether the patient presents risk factors that have to be considered before proceeding.

Patient classification ASA I, II, III (American Society of Anesthesiologists, 2014) must be considered for sedation. Patients in ASA III and those with anatomic airway issues, such as severe tonsillar, hypertrophy, necessitate further specific investigation (2, 8, 30, 34, 60, 88, 91), tht is a deeper evaluation by anesthesiologist (Table 2). According to ASA classification, patients in the first two classes are suitable candidates for sedation (46).

At this point, other specialists might be consulted if the patient is considered in need of advanced airway or cardiovascular management skills or a modification of type and dose of drugs used for the procedure (46).

Points that have to be made clear beside ASA, are the following.

- Age and gestational age at birth (preterm infants might be at higher risk of apnea).
- Weight (in kg) and BMI (obesity and anorexia).
- Height (in cm).
- Bad lifestyle habits (smoking, alcohol and drugs abuse).
- Past medical history, constituted by:
  - any allergy (eg. latex gloves);

ASA PS Classification	Definition	Adult examples, including, but not limited to	Pediatrics examples, including, but not limited to
ASA I	A normal healthy patient	Healthy, non-smoking, no or minimal alcohol	Healthy (no acute or chronic disease), normal BMI percentile for age
ASA II	A patient with mild systemic disease	Mild diseases only, without substantive functional limitations. Current smoker, social alcohol drinker, pregnancy, obesity (30<BMI<40), well-controlled DM/HTN, mild lung disease	Asymptomatic congenital cardiac disease, well controlled dysrhythmias, asthma without exacerbation, well controlled epilepsy, non-insulin dependent diabetes mellitus, abnormal BMI percentile for age, mild/moderate OSA, oncologic state in remission, autism with mild limitations
ASA III	A patient with severe systemic disease	Substantive functional limitations One or more moderate to severe diseases. Poorly controlled DM or HTN, COPD, morbid obesity (BMI 240), active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, ESRD undergoing regularly scheduled dialysis, history (>3 months) of MI, CVA, TIA, or CAD/stents.	Uncorrected stable congenital cardiac abnormality, asthma with exacerbation, poorly controlled epilepsy, insulin dependent diabetes mellitus, morbid obesity, malnutrition, severe OSA, oncologic state, renal failure, muscular dystrophy, cystic fibrosis, history of organ transplantation, brain/spinal cord malformation, symptomatic hydrocephalus, premature infant PCA <60 weeks, autism with severe limitations, metabolic disease, difficult airway, long term parenteral nutrition. Full term infants <6 weeks of age

TABLE 2 ASA classification.

- previous hospitalizations;
- family history, related to anesthesia (eg, muscular dystrophy, malignant hyperthermia, pseudocholinesterase deficiency) (46).
- relevant diseases (as detailed below).

• Pharmacological medical history:
- posology, time, route and site of administration of drugs taken by patient must be known;
- drugs that must be checked over are: anticoagulants, antiplatelets, bisphosphonates, anti-convulsivant drugs, central nervous system-acting drugs (cannabinoids, heroin, cocaine);
- previous sedation or general anesthesia, noting possible complications or adverse reactions;
- allergies to drugs (eg. penicillin, local anesthesia).

• Recent medical history.

There are several relevant diseases that have to be considered, including the following.

- OSAS (obstructive sleep apnea syndrome): it should be asked if the patient is using CPAP at night. Continuous positive airway pressure therapy (CPAP) machine helps a person, who has obstructive sleep apnea (OSA), to breathe easily during sleep, by increasing air pressure in the throat so that airways do not collapse when it is breathed in.
- Asthma.
- Neurological disorders, that can lead to airway obstruction.
- Cardiovascular, hepatic and kidney diseases.
- Genetic Syndrome and disorders.
- Diabetes.
- GERD (Gastroesophageal reflux disease).

The reason of the dental visit must be asked. Patients might come for a simple prevention check, or because they complain pain and/or oral dysfunctions. The patient must describe those disorders to help diagnosis. This is very importante and therefore patients with BMP who are not able to do so must be assisted during the visit by a relative or a caregiver.

After history taking is completed, the clinician must decide whether or not to operate the patient under sedation o general anesthesia. The dentist must communicate to the anesthesiologist if the patient is odontophobic or BMP, because it will be crucial for drug and sedation technique decision.

Physical examination

Physical examination is necessary for the dentist to plan dental treatment. This can and, in some cases, must be supported by radiological examinations, such as orthopanoramic x ray, CT, Cone beam CT and intraoral x-ray. Not all patients are compliant in these procedures, it depends both on the level of fear in dental phobic patients and on the disorder's severity of patients with BMP. Therefore, it is sometimes necessary to sedate uncooperative patients for TC, placing them in supine position. It is challenging to subject sedated patients to radiological examinations, thus the doctor will have to establish treatments, where possible, without the aid of these investigations.

When dental treatment is planned joining the intravenous sedation, an added value is given by carrying out multi-therapies in a single appointment, particularly providing conservative and rehabilitative surgical

Rating	Attitude	Definition
1	Definitely negative	Refusal of treatment, crying forcefully, fearful or any other overt evidence of extreme negativism
2	Negative	Reluctant to accept treatment, uncooperative, some evidence of negative attitude but not pronounced, i.e. / sullen, withdraw
3	Positive	Acceptance of treatment; at times cautious, willingness to comply with the dentist, at times with reservation but patient follows the dentist's directions cooperatively
4	Definitely positive	Good relation with the dentist, interested in the dental procedures, laughing and enjoying the situation

TABLE 3 Frankle Behaviour Scale.

dentistry. Nowadays, especially with children with BMP such as autistics, there is a tendency to proceed with a demolition therapy. For example, when a tooth has deep caries, instead of treating it conservatively with root canal treatment, many professionals prefer to extract the tooth. The problem is that if teeth are extracted in a child with these disorders, implants would have to be inserted to rehabilitate, but it would be a too invasive or difficult therapy. However, if no rehabilitation is done, the subject will have discomfort in chewing. Therefore, the dentist might have released the patient from pain caused by caries, but at the same time he has created another discomfort. As a consequence, these treatments must be aimed at saving patients' teeth by ensuring that they can correctly carry out chewing, speaking, swallowing functions and maintain aesthetics.

Objective examination will include a focused evaluation of physical status (ASA classification) and of adenotonsillar hypertrophy, anatomic airway or oral abnormalities (eg. mandibular hypoplasia).

At this point it is important for the clinician, if written consent has been signed by the patient or the tutor, to film the patient's attitude in a 15 seconds video. The anesthesiologist through body language, can partially asses the severity of the patient's disorder or fear, and then study the best anesthetic technique, approach to the patient and drugs to use.

As a consequence, both dentist and anesthesiologist may agree on the patient's collaboration level. Behaviour scales might help to classify patients conditions. An efficient measure is the Frankl behavior scale (FBS), which assesses behavior through a visual evaluation (Table 3). However, due to limitations in verbal communication with patients with BMP, the Venham picture test (VPT) is most frequently applied (Table 4).

Documents

The ability to give consent relies on a person's capacity to comprehend options and weigh them up clearly, to manage and dispose information related to the operation. A person is unable to make a decision if he/she can not: understand the information that is relevant to the decision; weigh up the information as part of the decision-making process and communicate their decision. Written information about sedation procedures available and the specific technique planned must be supplied, so that patients can absorb the information and comply with the instructions given. This is to be used with pre-operative assessment and face-to-face discussions and explanation.

Score	Behavior	Description	Brazilian version
0	Total cooperation	Best possible working conditions, no crying or physical protest	Score 0, no protest: the child has no physical protest, such as crying or body movements that disturb the dentist, enabling good working conditions
1	Mild protest	Soft verbal protest or (quiet) crying as a signal of discomfort, but not obstructing progress. Appropriate behavior for procedure, that is, slight start at injection, "ow" during drilling if hurting, and so on	Score 1, mild protest: The child protests quietly (grumbling) or contained crying as a sign of discomfort. However, this does not prevent the continuation of treatment
2	Protest more prominent	Both crying and hand signals. May move hands around making it hard to administer treatment. Protest is more distracting and troublesome. However, child still complies with request to cooperate	Score 2, intense protest: The child expresses discomfort verbally with strong crying and body movements that interfere with the performance of the procedure. However, he/she still meets the request to cooperate, even if with some resistance
3	Protest presents real problem to dentist	Complies with demands reluctantly, requiring extra effort by dentist. Body movement	

TABLE 4 Venham score.

Clearance of creatinine	Dabigatran		Apixaban		Rivaroxaban	
	Bleeding risk					
	Low	intermediate-high	low	intermediate-high	low	intermediate-high
≥ 80 ml/min	≥24h	≥48h	≥24h	≥48h	≥24h	≥48h
≥ 50-80 ml/min	≥36h	≥72h	≥24h	≥48h	≥24h	≥48h
≥ 30-50 ml/min	≥48h	≥96h	≥24h	≥48h	≥24h	≥48h
≥ 15-30 ml/min	Non indicated	Non indicated	≥36h	≥48h	≥36h	≥48h
< 15 ml/min	Non indicated					

TABLE 5 Timing of NAO's suspension.

Before medical check-ups and eventually undergoing sedation, patients or the caregiver, must be aware and endorse the following documentation.

Informed consent: Informed consent shall follow the legislation of the country. According to current regulations, a patient has to be informed about procedures and risks that may occur. Also, they must be informed about potential modification of behavior during and immediately after sedation (25, 42, 78, 115). This document should also be attached to the consent for patient's filming needed for pre-operative interventions. Forms must provide to the patient or his/her caregiver the following guidelines.

A 24-hour telephone number and e-mail of medical staff, including the dentist and the anesthetist.

Pharmacological instructions to follow before and after treatment, not only related to new drugs targeted to the operation, but also the ones in use. Information must include type of medication, posology and timing of assumption.

Patients must respect the following precautions.

1. Take antibiotic, only in case of dental surgery, such as amoxicillin and clavulanic acid, every 12h for 5 days. Antibiotic therapy begins the evening before surgery, making sure that the second tablet is taken after 12 hours and close to surgery.
2. Cortisone is prescribed only in case of dental surgery (eg. extractions or dental implants). Special attention should be paid to diabetic patients because cortisone raises glycemia.
3. Painkiller must be used after the operation and when needed in the following days (eg. FANS, class B morphine similars).
4. There are different opinions on antiplatelet agents. It would be better to suspend the drug four days before the operation if surgery is performed, while suspension is not needed for conservative treatments. The drug's suspension is chosen by the cardiologist and anesthetist according to medical protocols.
5. NOAC's (rivaroxaban, apixaban, edoxaban, dabigatran) interruption is based on renal function and bleeding risk (Table 5). Re-introduction timing is based on bleeding risk (Table 6).

	Low risk	Immediate-high risk
Re-introducing timing	24h after procedure	If immobilization is necessary, administer LMWH at a prophylactic dosage for venous thromboembolism 6-8 hours after the procedure, re-introduced the oral anticoagulant 48-72 hours after the procedure with immediate suspension of LMWH (no imbrication is performed)
		If immobilization is not necessary, re-introduce the oral anticoagulant 48-72 hours after the procedure
		If, due to the high haemorrhagic risk, the oral anticoagulant is not reintroduced within the indicated times, it is possible to start a bridging therapy with LMWH as per the TAO protocol

TABLE 6 Re-introducing timing for NAO.

If INR is 2-3, patients must stop TAO Warfarin 5 days before the procedure, whilst if INR>3, 6 days before the procedure. When patients undergo dental surgery INR<2, if other dental procedures are performed it could also be INR>2.

Bridging therapy must be pursued, therefore patients must initiate LMWH two days after Warfarin discontinuation. LMWH last administration will be 24 hours before the procedure.

Based on haemostasis and in patients who have undergone a low bleeding risk procedure, resume LMWH administration at the preprocedural dosage no earlier than 12 hours and no later than 24 hours after the procedure. In patients who have undergone an intermediate/high bleeding risk procedure, resume LMWH administration at the preprocedural dosage no earlier than 24 hours and no later than 72 hours after

the procedure.
Resume Warfarin 2-5 days (1-2 days with high thrombus embolic risk) after the procedure with preprocedural dosing for two consecutive days. Perform INR dosage and evaluate the posology for the following days based on it. LMWH administration should be continued until therapeutic INR is achieved (> 2 in two subsequent controls).

6. Bisphosphonates are life-saving drugs, both for osteoporosis and bone metastases. When teeth extractions are done, there is a high risk of osteonecrosis. Drug holiday is taken for at least 3 months. The c-terminal CTX telopeptide should be dosed at the beginning and after 3 months. If it is above 150 pg/ml, extractions are at low risk of osteonecrosis. After CTX is monitored and the drug has been stopped for 3 months, the patient will do 15-day antibiotic and antifungal therapy (flagyl) combined: for 7 days before and 7 days after surgery.

The patient must never be completely fasted when he undergoes surgery because he/she may have complications, such as metabolic acidosis. Consequently, patient with minimal stress must stop drinking and eating 3 hours before surgery, while 4 hours if he has a high level of stress.

On the operation day the patient must be accompanied in any case to assure a safe trip home. After undergoing intravenous sedation, driving or performing work must be avoided. Based on psychomotor function testing, driving must be avoided for 6 hours -10 hours after intravenous diazepam, and multiple sleep latency tests suggest to avoid it until 8 hours after administration of midazolam and fentanyl.

An adult who is well known to the child should always escort them to and from treatment. If the patient is an infant or a toddler, information must include how to keep his/her head in an upright position to avoid airways obstruction (46).

Pre-operative medical checkups

Before the patient undergoes an operation under sedation or general anesthesia, pre-operative examinations must be requested. Essential tests for the anesthetist are the following.

- ECG: it allows to record and view the electrical activity of the heart. By monitoring the blood pumping activity that the heart performs by means of contractions and releases, it is possible to identify the presence of heart disease or a rhythm disturbance (arrhythmia).
- Color-doppler echocardiography (only patients with serious heart disease): different colors are used to assess the blood's flow through the heart's chambers and valves. It can indicate a heart's functioning problem depending on the amount of blood pumped out with each heartbeat.
- Blood and urine tests: these should include complete blood count including blood group, glycaemia, CPK, blood creatinine, azotemia, the APTT and PT haemostasis tests (used to evaluate blood clotting times), level of fibrinogens and liver polyenzymes (which indicate the filtering capacity of the chemical compounds carried by the blood) and urinalysis consisting of proteins, electrolytes, bacteria, glucose and metabolism cells (verifies kidney function and indicates dysfunctions of protein catabolism).
- Chest x-ray (only patients with respiratory and lung disease such as COPD): the chest radiograph is not routinely indicated in the preoperative evaluation, it must be requested selectively on the basis of clinical and anesthetic indications. Chest x-ray, in the preoperative period, is justified only in the case of lung disease or risk.
- Spirometry: a spirometer test measures the amount of air breathed out in one second and the total volume of air exhaled in one forced breath. The results are compared with average values, which will help show if lungs are working physiologically. The measurements show whether patients have obstructive airways disease, restrictive airway disease, or a combination of the two.
- Arterial blood emogasanalysis (only patients with respiratory and lung disease such as COPD): this test measures the levels of oxygen and carbon dioxide present in arterial blood and blood pH. Usually, this is done from the radial artery. The levels of oxygen, carbon dioxide and blood acidity are indicators of lung function, because they measure the amount of oxygen released from the lungs into the blood and the quantity of carbon dioxide eliminated. It is required to verify the presence respiratory failure.
- Rapid antigen test by nasopharyngeal swab for Covid-19: the swab must be done no more than 2 days before the surgery in order to prevent healthcare personnel from being infected, and with them also future patients (Fig. 5).

Relational approach with patient

The day of surgery, the patient must be accompanied by a caregiver. It is advisable for the latter to remain in the hospital room until the patient is taken to the operating room. The patient must have the perception of being in a comfortable and safe place, where nothing and no one should arouse fear and anxiety. It is essential not to mention the intervention, especially in the case of patients with BMP, and not to show tools that can stimulate agitation. In the room there must only be a companion, dentist and anesthetist who will use the "distraction technique", that is to make the patient focus on other concepts by diverting him from the thought of the operation. Another crucial point is that the patient establishes a relationship of trust and empathy with the doctors. In the meantime, the anesthetist, through his/her experience, will study the patient's body language in order to carefully choose which drugs and dosage

FIG. 5 COVID-19 swab during pre-anesthesia.

will be necessary to use. If the patient cooperates in this sense, he/she can be placed on the dental chair and the anesthetist will insert the needle. If the patient is uncooperating, especially patients with BMP who may be aggressive, it is effective to make an intramuscular injection by distracting him with a hug. This allows the anesthetist to take venous access and to do medical examinations listed above, if it has not been possible. With pre-anesthesia the patient calms down and after a few minutes, venous access is taken. Before administering general anesthetics a sample is taken to not contaminate the blood and to avoid another puncture. At times, it may be useful to take another venous access to a larger vein than that used to administer the anesthetics for sampling.
The patient is then sedated and he/she can be moved to the operating table. The anesthetist must wait 20-40 minutes before deepening anesthesia.
After preanesthesia has been administered, it is necessary to avoid both verbal and physical stimulation to make the patient fall asleep. Before anesthesia deepens, it is necessary to insert the mouth openers because when the oral cavity tightens it is difficult to open it.

Intraoperatory equipment, documentation and procedures

Monitoring equipment are electrocardiography, pulse oximeters, blood pressure cuff and precordial stethoscope (32). The equipment necessary to establish intravascular or intraosseous access, to provide advanced airway management, and advanced cardiac life support must be available. Resuscitation medications and an appropriate defibrillator must be at hand. Adequate oxygen supply and appropriate airway equipment (nasopharyngeal and oropharyngeal airway, laryngoscopes blades, endotracheal tubes and bag valve mask) should be provided in case of emergency.
The patient's level of consciousness and responsiveness, heart rate, blood pressure, respiratory rate, expired carbon dioxide values and oxygen saturation have to be assessed and recorded continuously. The dentist and anesthesiologist must observe chest excursions and verify respirations. End-tidal CO_2 must be continuously monitored and evaluated in non-intubated patient. In addition, auscultation of breath sounds with a precordial or pretracheal stethoscope should be done.
Anesthetic record must be maintained, including the names of all drugs, dosages and their administration times, including local anesthetics. Adverse events and their treatment shall be documented (32).
Prompt response is required when level of sedation changes. If a patient enters a deeper level of sedation, the dentist must stop the dental procedure until the patient returns to the intended level of sedation.
Surgical field and airway path are the same site; the use of a mouth prop narrows the airways and water, due to the use of dental rotary tools, flows into the pharynx/larynx. Maintaining upper respiratory tract reflexes and avoiding swallowing, is extremely important in preventing airway obstruction and aspiration (79). Hence, suction of water from the oral cavity and the throat by the second operator is important.
Immobilization devices (46), such as papoose boards and fastening straps, must be managed to avoid airway obstruction and patient's movement as he is not curarized. Although patients are under anesthesia, they may perform involuntary movements similar to those that everyone does during non-drug-induced sleep. However, in phobic patients the fear and anxiety repressed in the subconscious is expressed with more rash movements, though in different ways depending on the subject's psychic state. Therefore, it is better to immobilize patients to prevent both them and the doctors from being harmed during the operation.
The dentist shall document every treatment performed and therapies that have been changed in progress from those established at the beginning.

Post-operative period

According to Italian law, ASA I and II patients can be operated in an outpatient healthcare facility while ASA III (eg. decompensated diabetic and catheterized patient) or intubated patients must be hospitalized in an inpatient healthcare facility. Actually, clinically ASA III can be operated in an outpatient facility, however the anesthetist should evaluate whether or not it is possible based on the underlying pathology or disorder.
In the outpatient healthcare facility, patient after

FIG. 6 Air forced warming devices.

surgery can remain under observation from a minimum of 30 minutes to a maximum of a few hours and then return home.
In the inpatient healthcare facility both day surgery and overnight stay are allowed. Patients usually do day surgery, whilst an overnight stay is preferred if surgery is very long and complex or if there are medical complications during general anesthesia, because they are under medical supervision all night long. Nevertheless, an ASA I or II patient who wants to feel safe, to have greater comfort or if he/she lives alone, can be operated in an inpatient healthcare facility. However, it is advisable to be aware of the law in force in the country where the operation is carried out.
When the surgery is finished, lights must be dimmed to gradually awaken the patient and commands are issued to restore the patient's responsiveness. At that point the patient is brought back to a properly equipped room with health personnel available. The hospitalization room must provide equipment for continuous monitoring of oxygenation, ventilation and circulation.
Post-operative symptoms can be represented by the following.

- Nausea and vomiting are possible complications and are linked to the use of opioid drugs, stress and fasting. To prevent this patients are generally given an anti-vomiting drug.
- Shaking can occur due to a lowering of the metabolism, and therefore of temperature, by fasting, that causes hypoglycemia, or by the state of muscular tension. It is found both during and after the operation. After surgery, air forced warming devices can be used (Fig. 6).
- Sleepiness.
- Hematomas and bruises at drug injection site.
- Muscle pains due to the position taken by the patient on the operating table.

The time and condition of the patient at discharge from the treatment area shall be documented. Recovery after intravenous sedation for cognitive and psychomotor functions is delayed. In the case of propofol, recovery of the sensory feeling of lightheadedness while walking is more delayed than psychomotor and balance functions. Parameters to be evaluated are consciousness, oxygenation, airway/ventilation, and circulation and urination.
In order to discharge patient, the following must be confirmed.

1 Vital signs are stable: blood pressure, pulse rate and SpO_2.
2 The basic psychomotor ability to recognize people, places and time has recovered.
3 Stable walking at normal speed is possible, or basic equilibrium function is restored. If recovery of equilibrium function is insufficient after sedation, there is a possibility of a fall. Caution is needed, especially in elderly patients.
4 Postoperative hemorrhage, pain or nausea and vomiting are not verified.

In a study conducted by Mummolo et al. in 2020 (66), emotional state and patient compliance improved one year after surgery in about 67% of patients, especially in children with odontophobia. On the other hand, children with severe autism showed less collaboration in post-intervention assessment. The approach with moderate sedation was effective for the improvement of compliance and mood of young patients.
Earlier studies indicated that high levels of stress and pain before and during dental procedures can significantly affect the level of postoperative pain (71, 81). As a consequence, sedation could make the post-operative period less painful and bearable.

COVID-19

Elective dental therapies are postponed. Only urgent therapies are performed. There are long waiting lists in public health facilities with the effect of postponing treatment and often aggravating the clinical situation with infection, pain and tooth loss, with serious functional, aesthetic, emotional and economic repercussions.
"Special need" patients have problems in performing both swabs and serological tests, and in carrying out multi-visit treatment plans, as access to clinics is limited in order to guarantee interpersonal distancing.
In this scenario, the "one-day dental treatment" concept in intravenous sedation in the operating room in a private health facility changes the paradigm of dental care even more.
In our protocol, both the rapid swab and blood tests are performed in the pre-anesthesia phase before accessing the operating room, guaranteeing treatment for patients who have difficulty in carrying out pre-hospitalization.
Dental care is concentrated in a single visit and is performed in maximum safety in a protected environment where strict procedures for the prevention of COVID-19 contagion are implemented, including the

continuous monitoring of healthcare personnel.
The patient does not have to go to the dental clinic several times and dental need is met quickly and painlessly.

CONCLUSIONS

Our personal experience, our knowledge and the data of scientific research have allowed us to develop guidelines that dentists could follow in case of complex patients. Our protocol aims to identify patients who require dental sedation to ensure that they can enjoy excellent oral health. General anesthesia applied with our method, is an effective technique in the treatment of patients with special needs.
Despite this, we are strongly convinced that the horizon of new knowledge should always remain open, that a multidisciplinary collaboration between professionals is essential and that it is necessary to constantly update ourselves to improve our performance and ultimately patient well-being.

Conflicts of interest

There are no conflicts of interest.

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