en técnicas avanzadas de reanimación (ACLS).[3] La Norma Oficial Mexicana menciona en sus disposiciones generales: «El personal de Estomatología debe estar capacitado para proporcionar primeros auxilios a quien sufra lesiones accidentales con instrumental o material contaminado en el área estomatológica, para realizar maniobras básicas de reanimación cardiopulmonar y soporte básico de vida».[36]

Es frecuente que el anestesiólogo no esté familiarizado con un consultorio dental, lo que aumenta la dificultad de administrar una técnica anestésica segura. Además, los medicamentos y suministros a menudo no son de fácil acceso y la gran mayoría no cuenta con equipos de anestesia estándar y monitores adecuados.[4,6] Durante una reanimación cardiopulmonar en el consultorio dental, el anestesiólogo se puede encontrar con un equipo de menor experiencia y con menos entrenamiento en habilidades en comparación con el personal de quirófano.[28] Las mayores distancias físicas con otros anestesiólogos y colegas quirúrgicos también son barreras para el apoyo oportuno y aumentan el riesgo de demoras en caso de una emergencia.[4]

Cuando se proporciona sedación o anestesia general en un consultorio dental, el odontólogo debe ser responsable de evaluar las calificaciones educativas y profesionales del anestesiólogo, además debe involucrarse con los siguientes aspectos de la atención para minimizar los riesgos del paciente: instalaciones, equipos, monitoreo, documentación, selección de pacientes, evaluación preoperatoria, personal de apoyo debidamente capacitado, medicamentos de emergencia, protocolos, indicaciones pre- y postoperatorias, criterios de recuperación y egreso del paciente.[16]

CONCLUSIONES

La administración de cualquier técnica anestésica en el consultorio dental es segura y efectiva cuando se consideran factores fundamentales que van desde la selección adecuada del paciente, duración del procedimiento, técnica quirúrgica, instalaciones y equipos apropiados, hasta el personal capacitado, potencial de eventos adversos y la capacidad de rescatar al paciente en caso de que este lo requiera.

La vigilancia de todos los detalles, por pequeños que sean, y el cumplimiento absoluto de la Norma Oficial Mexicana y la Guía de la Asociación Americana de Odontología Pediátrica (AAPD) sobre el monitoreo y manejo de los pacientes antes, durante y después de la sedación para procedimientos diagnósticos y terapéuticos (actualización 2016), u otras guías apropiadas y diseñadas para incorporar principios de seguridad pueden reducir la morbimortalidad en la atención al paciente en el consultorio dental.

Los consultorios dentales deben desarrollar un protocolo para optimizar la atención del paciente y la gestión de emergencias. Todo el personal involucrado debe estar capacitado, actualizado y familiarizado con los protocolos y equipos de emergencia. Los odontólogos y anestesiólogos deben contar con una certificación obligatoria en soporte vital básico y avanzado.

La falta de adherencia a la normatividad vigente puede resultar en una deficiente calidad y seguridad en la atención de los pacientes, lo que en numerosas ocasiones tiene alcances de índole legal. El ejercicio profesional de manera cuidadosa y reflexiva mejorará la seguridad del paciente y la calidad de su atención. Los profesionales de la salud deben perfeccionarse, vencer sus límites y actualizarse mediante una capacitación continua, además debemos esforzarnos para mejorar por los pacientes que nos confían su salud y seguridad.

Special article

Safety of the patient under anesthesia in the dental office

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ABSTRACT

Today, dentists offer their patients increasingly complex interventions outside the operating room, but caution should be exercised as each patient has unique needs and should be evaluated with a complete medical history. Most dental procedures can be performed using only local anesthesia; however, sedation to patients in the dental office has increased in recent years, so the safety of dental anesthesia will depend on the anesthetic objectives, patient selection, anesthetic technique, medication selection, supervision, training of the medical and dental team, and the preparation to handle unexpected complications and emergencies. Anesthesiologists and dentists should thus understand the complications and risks to which patients can be exposed without adequate monitoring. Therefore, dental offices must develop a protocol to optimize patient care and emergency management.

Keywords: Safety, dental anesthesia, sedation, monitoring.

OBJECTIVE

The objective of this work is to provide up-to-date medical and dental literature information on safe

anesthetic techniques used in the dental office and to suggest methods to improve patient care. This review aims to ensure that the dentist carries out a thorough analysis of the patient before any diagnostic or therapeutic procedure, besides the performance of a complete review of the dental staff, facilities, equipment, monitoring and protocols necessary to minimize adverse events and complications of an anesthetic procedure. The above will help to provide optimal, responsible, and high-quality care to patients.

BACKGROUND

Provision of dental services warranting quality and patient safety is an undoubted right for anyone.[1] The stressful scenario of a dental procedure requires proper management of anxiety, pain, and related physical reactions to improve the overall safety of dental care, making the patient-centered approach the ethical gold standard in modern dentistry.[2] The administration of sedatives and general anesthesia is safe when clinical indications are met, properly trained and accredited staff participate, and appropriate facilities and equipment are used.[3]

With the advent of less invasive procedures dentists can offer patients with challenging medical conditions increasingly complex interventions outside the operating room.[4,5] Anesthesiologists and dentists should understand, however, the complications and risks to which patients may be exposed.[6] Most dental procedures can be performed only with local anesthesia,[7] but the use of sedation in dental offices for the care of certain patients, especially children, has increased in recent years.[8] For instance, the use of sedatives and general anesthesia in dental offices is widely established in the United States (US), being a safe and successful procedure.[9]

The estimated number of pediatric dental sedations in the US is 100,000 to 250,000 per year.[10,11] Although most of them have no complications, there are some cases with adverse results[12] and there is no mandatory report of these events, so it is unknown how often they occur.[10] The practice of anesthetic techniques in the dental office represents a unique situation compared with their use in the hospital environment. The differences are often not clearly understood; as a result, there may be adverse events that could have been avoided.[13]

The differences between intra-hospital and dental office practices raise many safety concerns. For example, private dental offices may have fewer resources than other surgical care settings and often have fewer staff and equipment available when complications of the anesthetic and dental procedures arise.[5] The combination of an airway shared between the dentist and the anesthesiologist, the variety of surgical techniques that keep the airway open, and the dental office environment often results in anxiety and suspension of procedures by the anesthesiologist.[7]

As specialists, anesthesiologists are trained to provide the safest possible patient care regardless of comorbidities and type and site of procedure.[5,6] Nonetheless, even with a high level of training in anesthetic procedures performed in an optimal dental office, there is a serious risk of morbidity and mortality.[14] From a legal perspective, non-compliance with safety principles has been found to have directed patients to make medical-legal claims based on inadequate procedures, adverse results, or treatment sequelae, which generate responsibility on the part of the health care professional.[15]

INDICATIONS FOR DENTAL ANESTHESIA AND PATIENT ASSESSMENT

Caveats for sedation or general anesthesia in dental treatment are diverse; these include dental phobia, acute situational anxiety, pediatric patients, extensive or complex dental surgical procedures,[7,16-19] patients with mental, psychiatric, or neurological disorders,[16,20,21] patients with an increased vomiting reflex,[16,17] and patients with multiple medical comorbidities[7] or showing a severe clinical condition.[16]

Specific indications for sedation or general anesthesia in a dental office improve patients' selection process. Proper airway assessment and strategies to ensure air flow through a difficult airway are paramount due to the nature of the procedures and the patients in which they are performed.[7] On the other hand, it will always be necessary to evaluate the administration of sedation or general anesthesia in a hospital setting, especially for patients with poor physical condition, difficult airway, and long or multidisciplinary surgeries.[22]

Before performance of any anesthetic and dental procedure, patients should be evaluated with a complete medical history, including medication use, allergies, surgical and prior anesthetic histories, functional status, and social habits including the use of illicit drugs.[7,11,18,19,23-27] A complete physical examination of apparatus and systems should be carried out, in addition to height, weight, and vital signs measurement, full airway assessment,[7,19,23,25,26,28] and classification of the patient's physical condition according to the American Society of Anesthesiologists (ASA).[11,18] The specific procedure to be performed will

also determine the aspects to be further evaluated.[28] Lastly, laboratory tests and medical consultations should be done when indicated.[7]

Even with qualified staff, safe drugs, and appropriate monitoring equipment, poor patient selection can end up in unplanned and catastrophic results.[29] Each dental procedure is unique; more importantly, each patient has unique needs based on their health, age, weight, and level of cooperation. Careful and thorough evaluation of the patient by investigating factors that may lead to difficulties and complications is an absolutely necessary strategy in an anesthetic-dental procedure within a dental office, where there is space limitation and difficult access to auxiliary services and emergency personnel.[28,30]

The use of an operating room increases the costs of an anesthetic-dental treatment as it involves hospital expenses and fees of the staff involved (dentist, dental assistant, anesthesiologist, nurse, etcetera).[20] This situation contributes in many cases to the provision of care in the dental office despite not being the safest environment.

One of the indicators of patient safety in medical and dental care is informed consent. This tool helps provide the patient with detailed information about planned management, concerns, potential risks, and benefits of both dental and anesthetic procedures. Today its use is essential to avoid misunderstandings between the health professional and the patient.[1,23,24,28] Furthermore, informed consent must be obtained from the legal guardian if the patient is a minor or has any limitations.[23]

ANESTHETIC TECHNIQUES USED IN THE DENTAL OFFICE

An anesthetic technique is defined as the set of procedures or resources used in Anesthesiology to protect the patient from pain before, during, and after any surgery or diagnostic examination. Anesthetic techniques in Dentistry include the full spectrum of anesthesia, from local, regional anesthesia, oral, parenteral or inhalation sedation to general anesthesia.[7] No anesthetic technique alone is better than another, but must adapt to the particularities of the patient, proposed objectives, context, and obstacles encountered.[15] The anesthetic management of any patient always requires the interdisciplinary communication and collaboration at the pre-, trans-, and postoperative levels.[31]

Local anesthesia involves the temporary loss of sensation in a specific part of the body by injection or topical application of an agent without decreasing the level of consciousness.[32] Local anesthetics are vasodilators, are absorbed into circulation and should be used with caution due to their rapid systemic absorption that may result in overdose poisoning.[8,32] Using local anesthetics containing vasoconstrictors reduces toxicity by decreasing the rate of systemic absorption of the anesthetic.[32]

The application of a topical anesthetic can help minimize the discomfort caused by local anesthesia administration. A topical anesthetic is effective in surface tissues (up to 2-3 mm deep) to reduce pain during needle penetration into the oral mucosa. These agents are available in gel, liquid, ointment, patch, and spray form. The risk of acquired methemoglobinemia has been mainly associated with two local anesthetics: prilocaine and benzocaine.[32]

The dentist should know the appropriate dose based on the patient's weight (special attention must be paid to in pediatric cases) and not exceed the maximum dose to minimize the possibility of toxicity and prolonged duration of anesthesia.[8,32] Early recognition of a toxic response is critical for effective management. When signs or symptoms of toxicity are observed, administration of a local anesthetic should be discontinued immediately. Toxicity management is based on the severity of the reaction.[32]

Sedation is defined as the use of a drug or a combination of drugs to depress the Central Nervous System (CNS), which reduces the patient's awareness of her/his environment.[21] The ASA establishes different levels of sedation in a patient by assessing four parameters: responsiveness, airway integrity, spontaneous ventilation, and cardiovascular hemodynamics.[12,26] Sedation levels are classified as minimal, moderate, and deep. At more severe CNS depression levels general anesthesia is achi eved.[7,8,11-13,16,18,21,24-26] Sedation is a continuum and there is always a risk that the patient's airway will be compromised; yet this may go unnoticed in the absence of adequate monitoring.[12] Sedation does not control pain, so the use of local anesthetics is indicated;[21] however, doses of local anesthetics should be reduced when administered in combination with any sedative agent.[32]

The goals of sedation and general anesthesia for diagnostic and therapeutic procedures in the dental office are to protect the safety and well-being of the patient, minimize physical discomfort, decrease pain, control anxiety, lessen the psychological trauma, optimize the effect of amnesia, allow the safe completion of the procedure by tranquilizing the patient and reducing movement, and recover the condition of the patient for safe discharge.[3,27]

MONITORING AND REQUIRED EQUIPMENT

The field of Anesthesiology is a leader in patient safety and has identified and implemented measures to increase the stability of the patient undergoing an anesthetic-surgical procedure;[10] nevertheless, even in the hospital environment there is an inherent risk of death and complications in patients.[9] The anesthesiologist has the responsibility to ensure the safe and effective administration of the anesthetic technique of his choice that best suits the objectives of the procedure to be performed, individualizing each patient.[16,28] Pediatric patients and those with special needs represent specific challenges of evaluation, induction, and anesthetic management.[7]

Sedation or general anesthesia should be carried out by a qualified anesthesiologist[25] who will be responsible for administering medication to the patient, continuously monitoring her/his vital signs, airway permeability, ventilation, and cardiovascular and neurological status.[3] To achieve the above, the anesthesiologist has direct observation, as well as the use and interpretation of cardiovascular and respiratory monitors.[12] Appropriate physiological monitoring and continuous observation allow rapid and accurate diagnosis of complications and timely initiation of patient rescue interventions.[27] Experts recommend that the room where sedation is administered must have complete surgical and anesthesia equipment, a reliable supply of oxygen capable of providing O_2 at positive pressure, suction equipment, feasibility of quickly placing an intravenous access, equipment to maintain a permeable airway (Guedel cannula, endotracheal tube, laryngeal mask, etc.), medication needed for resuscitation, and a defibrillator.[7,18,23,27,33]

The ASA, the American Dental Association (ADA), the American Association of Pediatric Dentistry (AAPD), and the American Association of Oral and Maxillofacial Surgeons (AAOMS) describe the monitoring requirements for dental anesthesia and agree on the guidelines for monitoring during sedation or general anesthesia. These recommendations are based on the depth or level of sedation of the patient. In order to offer a safe environment for patients undergoing sedation or general anesthesia, the dental office should provide monitoring similar to the environment of an operating room.[28] Continuous monitoring of peripheral oxygen saturation, electrocardiogram, respiratory rate, blood pressure, and temperature (if needed) should be performed.[7,11,12,18,19,25,26,34] In addition, a continuous bidirectional verbal communication between the anesthesiologist and the patient (if possible and/or appropriate) should be established. If this communication is not possible, monitoring of capnography and use of pretracheal or precordial stethoscope should be added.[3,7,11,12,18,27,34]

Capnography consists of the monitoring of breathed carbon dioxide. It is valuable to diagnose the presence or absence of breaths making easier the recognition of apnea by airway obstruction or respiratory depression several minutes before this situation is detected by pulse oximetry. The latter parameter delays the diagnosis due to the increase in oxygen reserves in the patient receiving supplemental O_2. Capnography thus permits an earlier intervention.[27]

Another type of monitoring currently used is the bispectral index (BIS), which assesses the depth of sedation in a non-invasive manner. This technology was originally designed to examine the signals of the electroencephalogram, and through a variety of algorithms correlates a number with the depth of unconsciousness. That is, the lower the number the deeper the sedation.[27] Recent studies suggest that the use of BIS during dental anesthesia reduces anesthetic drug requirements and improves recovery times.[7]

All monitored parameters must be continuously recorded on an anesthetic log sheet throughout the procedure.[12] After sedation or general anesthesia, the patient must be monitored in the recovery area, which must be properly equipped with a functional suction apparatus and supplemental oxygen and ventilation with positive pressure, in addition to appropriate equipment and rescue devices.[7,8,18,23,28] Before patient's discharge from the dental office, the anesthesiologist should perform an evaluation and monitoring of respiratory, cardiovascular and neuromuscular function, mental state, temperature, pain and the presence of nausea or vomiting. All patients should have a responsible person accompanying them. Written aftercare instructions and warning signs should also be provided.[7,23,27,28]

The familiar working environment for all staff involved in patient care and the level of experience of the anesthesiologist are probably the most crucial factors for the efficiency of a surgical procedure in the dental office.[22] The anesthesiologist should evaluate the resources available there (both in staff and equipment) to deal with possible complications. Specifically, it should be concluded whether the location and resources are adequate to offer a safe anesthetic-dental procedure.[5] The dentist is responsible for establishing a secure environment in her/his office that also complies with local, state, and federal standards and regulations.[27]

It is currently not acceptable to administer sedation or general anesthesia in an unsupervised

environment.[28] Some dental offices have a variety of limitations or were not designed for the addition of anesthesia equipment, which hinders the ability to provide the highest and safest level of patient care and optimal emergency management.[4] Evidently, the monitoring described above may be increased at any time if medical and dental staff consider that the change improves patient safety.[3,27] On the other hand, it is well known that inappropriate monitoring results in the inability to properly recognize and respond to an adverse event.[10]

ADVERSE EVENTS AND COMPLICATIONS

Risk is inherent to any anesthetic-dental procedure.[11,35] The short duration of a lesion or the absence of sequelae do not rule out the presence of an adverse event. Most adverse events are satisfactorily resolved because the effect caused on the patient is minimal; in many cases there are no sequelae and patients are not aware of any complication.[1]

The precise number of anesthetic procedures in dental offices is unknown; the exact incidence cannot be calculated and therefore the risk of adverse events related to anesthesia in this field is undetermined.[5,10,30] Much of the knowledge on the current impact of such events comes from data on legal complaints provided by the ASA, which provides only statistical figures of litigation cases.[6]

Medical emergencies are acute, generally unforeseeable events that endanger an organ or function and even the life of the patient, so immediate attention is warranted. Luckily, in dental practice emergencies are rare and of moderate magnitude.[33] Immediate activation of emergency medical services may be required, but the medical and dental staff involved are responsible for basic life support measures until arrival of emergency services.[8,34]

Anesthetic complications during sedation or general anesthesia include failed procedures resulting from inadequate anesthesia, medication errors, airway injury, hypoxia, respiratory arrest, cardiovascular commitment, anaphylaxis, and cardiac arrest.[6,8,26-28] The most serious adverse outcomes are brain damage and death. Fortunately, they are rare, although it is impossible to estimate their exact incidence[12] as there is no mandatory reporting system and only two imperfect sources of information are available, namely media reports and legal claims.[10]

Sedation and general anesthesia in a non-hospital environment have historically been associated with a higher incidence of «rescue failure» of adverse events as there may be no immediate available support or supplies for patient rescue.[8,28] Most sedation complications can be handled with simple maneuvers such as supplemental oxygen, airway opening, suction, placement of a device for airway permeabilization, and assisted ventilation. Sometimes tracheal intubation is required for longer ventilatory support.[8] Despite the above, adverse events with tragic results are mainly respiratory in nature.[5-9,12,28,29] Children have the highest risk and the lowest tolerance for error in patient safety during sedation procedures.[3]

The most common postoperative complications are nausea, vomiting, agitation and/or postoperative delirium, hypothermia, desaturation (peripheral oxygen saturation < 90%), epistaxis (in nasotracheal intubation),[7,20] increased secretions, and prolonged sedation and recovery.[27] While it is impossible to completely eliminate the risk, negative results can be minimized by optimizing work systems and eliminating human error.[11]

To reduce the risk of medical errors and determine cause-effect relationships, adverse events should be meticulously recorded and analyzed for future reduction of associated risks. This will improve patient satisfaction and avoid legal conflicts.[16,24,30,35] The inaction or passive behavior of the health care professional is manifested by hiding evidence and failing to analyze and propose measures to solve a situation and communicate results. As a consequence, patients remain exposed to risks arising from bad practices.[24]

CONSIDERATIONS ON CARDIOPULMONARY RESUSCITATION IN THE DENTAL OFFICE

Most oral health care is performed in individual private consultations, where the professional is alone and care responsibilities fall on him.[15] Unfortunately, some dentists do not have the training to resuscitate a patient with respiratory or cardiac arrest.[14] Some data suggest that by the time the dentist recognizes cardio-respiratory arrest, too much time has elapsed, reducing the chances of success in resuscitation.[9] This fact emphasizes the importance of the dentist's ability to diagnose and manage adverse events as they occur.

The literature mentions that the dentist must be trained in basic cardiovascular life support (BLS) and is responsible for these measures while waiting for the emergency medical service to arrive.[27] It is even recommended that the dentist is trained in advanced resuscitation techniques (ACLS).[3] The Official Mexican Standard indicates in its general provisions: «Stomatology staff must be trained to provide first aid for those who suffer accidental injuries with contaminated instruments or material in the stomatological area and to perform basic CPR and basic life support maneuvers».[36]

The anesthesiologist is often unfamiliar with a dental office, which increases the difficulty of administering a safe anesthetic technique. The location is usually remote from trained staff; medications and supplies are often not easily accessible and most dental offices do not have standard anesthesia equipment and adequate monitors.[4,6] During cardiopulmonary resuscitation in the dental office the anesthesiologist can encounter a less experienced team with less training compared with the operating room staff.[28] Greater physical distances with other anesthesiologists and surgical colleagues are also barriers to timely support and this increases the risk of delays in the event of an emergency.[4]

When sedation or general anesthesia is administered in a dental office the dentist should be responsible for evaluating the educational and professional qualifications of the anesthesiologist. The dentist should also take into consideration the following aspects of care to minimize patient risks: facilities, equipment, monitoring, documentation, patient selection, preoperative evaluation, properly trained support staff, emergency medications, protocols, pre- and postoperative indications, recovery criteria, and patient egress.[16]

CONCLUSIONS

The administration of any anesthetic technique in the dental office is safe and effective when fundamental factors are considered, including proper selection of the patient, duration of the procedure, surgical technique, appropriate facilities and equipment, trained staff, potential for adverse events, and the ability to rescue the patient if needed.

The monitoring of all details as small as they are is key to improve safety, thus reducing morbidity and mortality in patient care in the dental office. Absolute compliance with the Official Mexican Standard and the Guide of the American Association of Pediatric Dentistry (AAPD) on the monitoring and management of patients before, during, and after sedation for diagnostic and therapeutic procedures (update 2016), or with other appropriate guidelines designed to incorporate safety principles is also essential.

Dental offices must develop a protocol to optimize patient care and emergency management. All staff involved in patient care must be trained, up to date, and familiar with emergency protocols and equipment. Dentists and anesthesiologists must have a mandatory certification in basic and advanced life support.

Lack of adherence to current regulations can result in poor quality and safety in patient care, which may entail legal issues. Careful and thoughtful professional exercise will improve patient safety and quality of care. Health professionals need to perfect their practice, surpass their limits, and update their skills through ongoing training. They must do it for their patients, who entrust them with their health and safety.

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