

GRADUATION PROJECT

Degree in Dentistry

MEDICAL EMERGENCIES IN DENTAL CLINICS. A DESCRIPTIVE STUDY BASED IN QUESTIONNAIRES TO DENTISTS

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Abstract:

Introduction: Medical emergencies might occur during a dentist's working career, however there are ways of trying to prevent them from happening and manage them. With the help of a questionnaire, the occurrence of medical emergencies in the dental clinic was examined. The author's target is to create awareness regarding medical emergencies in the setting of a dental clinic. **Objectives:** To identify the most common medical emergencies that occur in a dental clinic; to analyse how dentists handle medical emergencies in a dental clinic. **Methodology:** A questionnaire of 26 questions was prepared in English and Spanish, and was sent to dentists in England, France, Sweden and other countries through an online survey between December 2022 and February 2023. This was done in order to get a broad range of results that will be comparable with one another. **Results:** A total of 100 dentists answered the survey and found that Hyper/hypotensive crisis, Syncope and Diabetes were the most common medical emergencies seen in a dental clinic. 33.3% of dentists experienced a patient having a hyper/hypotensive crisis, 12.7% saw a syncope episode, and 15.9% had a patient suffering from a diabetic attack. **Conclusion:** Dentists will experience at least one medical emergency when working, and one of the main methods of reducing the incidence of a medical emergency occurring is by obtaining detailed medical histories of the patients and monitoring their vital signs. The most common medical emergency is hyper/hypotensive crisis followed by syncope episode. **Key words:** Dentistry, choking, emergency, syncope, medication, prevention and treatment.

Resumen:

Introducción: A lo largo de la carrera profesional de un dentista pueden producirse emergencias médicas, pero hay formas de evitarlas y gestionarlas. Con la ayuda de un cuestionario, se examinó la ocurrencia de emergencias médicas en la clínica dental. El objetivo del autor es concienciar sobre las urgencias médicas en el entorno de una clínica dental. **Objetivo:** Identificar las urgencias médicas más comunes que se producen en una clínica dental; analizar cómo manejan los dentistas las urgencias médicas en una clínica dental. **Metodología:** Se preparó un cuestionario de 26 preguntas en inglés y español, y se envió a dentistas de Inglaterra, Francia, Suecia y otros países a través de una encuesta en línea entre diciembre de 2022 y febrero de 2023. Esto se hizo con el fin de obtener una amplia gama de resultados que serán comparables entre sí. **Resultados:** Un total de 100 dentistas respondieron a la encuesta y descubrieron que las crisis de hiper/hipotensión, el síncope y la diabetes eran las urgencias médicas más comunes atendidas en una clínica dental. El 33.3% de los dentistas tuvieron un paciente con una crisis hiper/hipotensiva, el 12.7% un síncope y el 15.9% un ataque diabético. **Conclusión:** Los dentistas sufrirán al menos una urgencia médica cuando trabajen, y uno de los principales métodos para reducir la incidencia de que se produzca una urgencia médica es obtener historiales médicos detallados de los pacientes y controlar sus constantes vitales. La urgencia médica más frecuente es la crisis hiper/hipotensiva seguida de un episodio de síncope. **Palabras clave:** Odontología, asfixia, urgencias, síncope, medicación, prevención y tratamiento.

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I. Introduction

1. 1 Concept

Even though it is seen that medical emergencies occurring in a dental clinic is a rare event (dentists roughly experience 2-3 medical emergencies each year) it is not completely inevitable. (1) There are a few reasons as to why this is the reason:

- Drugs, especially anaesthesia, can cause secondary effects and interactions.
- Invasive dental interventions can cause post operative complications which are not always trivial.
- If no precautions are taken, drug prescriptions may interfere with other medications.
- The act of going to the dentist is known to be anxiety provoking to many patients which can alter the patients' general condition.

Dentists need the knowledge and skills necessary to prevent or manage medical emergencies that may occur in their dental clinic, as well as receive regular training to renew their knowledge.

The key element in medical emergencies is prevention. The majority of medical emergencies can be avoided by following a few steps:

- Clinical history that allows the identification of previous medical conditions.
- Risk Assessment being conducted based on the patients physical and psychological examination following ASA guidelines.
- Implementation of preventive measures such as premedication and complementary examinations.

In addition, the way in which the dentists conduct themselves is extremely important as a precise diagnosis and early treatment are essential to ensure the patients safety.

This can be done in several ways:

- Assessment of vital signs (pulse rate, blood pressure, body temperature and respiration rate).
- Be ready to call a medical team (ambulance).

- First aid measures (cardiopulmonary resuscitation, placing the patient in the recovery position).
- Implement immediate treatment by giving emergency medication.
- Monitor the patient until the arrival of the advanced medical team.

Dentists must ensure the safety of their patients by having an emergency medical kit in their dental practise and have the knowledge and skills to use the equipment correctly and efficiently.

This raises the question on whether dentists have the understanding and expertise to handle a medical emergency occurring in their dental clinic.

1.2 Medical Emergencies: Types and Definition

Syncope

Syncope is known as a loss of consciousness and postural tone. (1) Syncope often occurs in a dental clinic due to stress, anxiety, and fear of pain induced during a dental treatment. Dentists must play a role in preventing syncope from happening, know how to manage a patient when suffering from syncope, and be able to differentiate it from other possible medical emergencies.

However, research has shown that many dental professionals do not feel confident in managing this medical emergency due to their belief of having lack of training and education. (1)

Hypertensive emergency

Hypertension is characterised by having a blood pressure reading above 140/90mm Hg. One of the main difficulties when treating a patient with hypertension is the lack of physical signs or symptoms on the patient until it becomes a medical emergency. (2) Many patients may not take their medication correctly and therefore put themselves and the dentist at risk during a dental treatment.

For that reason, completing a medical history analysis as well as questioning the patient on their daily use of medication can prevent a hypertensive emergency transpiring. Follow up

appointments as well as consulting with their general practitioner can decrease the possibility of the patient having a hypertensive crisis in a dental clinic.

Allergic Reaction

A severe allergic reaction is known as an anaphylactic shock. Allergic reactions are manifestations of hypersensitivity in the body after ingestion, injection, inhalation, or contact with a certain substance. There are multiple circumstances where an allergic reaction can take place. (3)

- Latex gloves: many people do not know they have an allergy to latex as it is not a material that people are exposed to frequently. However, it is associated to allergies of kiwi and banana therefore must be avoided in any patients who are allergic to these fruits.
- Medication such as penicillin or some analgesics.
- Local anaesthesia especially those belonging to Ester group.

Anaphylaxis reactions can be presented in multiple ways being urticaria and shortness of breath the most common symptoms. (3) The protocol to follow when a patient is having an allergic reaction:

1. Evaluate the patient's vital signs.
2. Stop procedure and remove any materials or agents that could be triggering the patient.
3. Elevate the patient's legs if there is difficulty of breathing.
4. Administer intramuscular adrenaline 0.3mg and provide oxygen via a face mask.
5. Call the ambulance.
6. Continue monitoring vital signs until the ambulance arrive.

As with any medical emergency, the vital signs should be constantly monitored as well as ensuring the patient remains conscious. For mild allergic reactions, the dentist can administer a histamine blocker, such as diphenhydramine, either intramuscular or oral route. (4)

Cardiac Arrest

Cardiac arrest is defined as the complete disappearance of heart activity and is the most life-threatening emergency in everyday life and in a dental clinic. (5) During a cardiac arrest, blood is no longer circulating in the body leading to organs shutting down. Therefore, the main objective of the treatment is to restore an efficient blood flow. Time is very crucial in these medical emergencies because the sooner the organs are revascularized, the better the prognosis of the patient.

The first action to take in a medical emergency is to check whether the patient is conscious or not. If not, the dentist must examine the patient's breathing and if there are no signs of breath then the patient is in cardiac arrest. There are multiple ways of handling a cardiac arrest such as CPR or using a defibrillator. It is crucial that dentists as well as dental assistants know the sequence of CPR and how to use a defibrillator, because as mentioned previously, actions need to happen almost immediately after we suspect a cardiac arrest.

Inhalation of Objects

Inhalation of an object during dental treatment is very common as dentists are frequently using small materials and instruments that can easily fall into the patient's mouth. However, if the dentist is not careful, it can cause serious airway obstruction and potentially lead to suffocation. Some examples of objects are:

- Endodontic files
- Burs
- Dental debris

If an object has been ingested, an immediate x ray must be taken to see the extent of the damage. Objects blocking the patient's airway can be due to the patient moving, the dentist having restricted access to the patient's mouth, and lack of a rubber dam.

In cases where the patient stops breathing due to their airway being blocked, the dentist must act fast to save the patient's life. The Heimlich is a movement conducted by the dentist to force the object out of the patient and open up their airway. If this is not successful, then hard taps on the patient's back must also be done in between the Heimlich manoeuvre.

The dentist and dental assistant must take special care when treating the patient in a supine position and the instruments or materials can easily slide down or fall into the patient's throat. Preventive techniques such as a rubber dam can greatly decrease the probability of this occurring. (6)

II. Objectives

Main objectives:

- To identify the most common medical emergencies that occur in a dental clinic.
- To analyse how dentists handle medical emergencies in a dental clinic.

III. Material and Methods

3.1 Keywords, Research strategy and Survey

Key words: Dentistry, choking, emergency, syncope, medication, prevention, and treatment.

A questionnaire was made (Appendix 1), in English and Spanish, consisting of 26 questions and a consent to participate in the survey to be given to dentists in multiple countries including England, Spain and France. My questionnaire was approved with the number OD. 002/2223 (CIP/22.358).

3.2 Article Selection

The author's aim is to create awareness of the different medical emergencies that may occur in a dental clinic and ways to prevent or treat them. The data was compared with other available articles and the results were statistically analysed.

Bibliographic Research to support my results obtained from the questionnaire

PubMed was the research platform of choice to find articles. However, MedLine was also used for further investigation into the topic of Medical Emergencies in a Dental Clinic.

- At first, I started my research in PubMed by searching 'Medical emergencies in dental practise' which gave me 1,232 results. I then selected 'free full text' and '10 years old publication date' and obtained 503 articles.
- After I searched in MedLine using the same start search 'Medical emergencies in dental practise' and found 1,105 results. Adding the filter 'full text' and '2010-2023' I obtained 105 articles.
- After reading some of the articles left after the selection of specific key words, 105 articles were left with 54 articles being useful for my research.

III. Results

The majority of dentists that completed my questionnaire were from France (35.7%) and England (28.6), while 17.1% were from Sweden, 11.4% were from Spain and 7.1% were from another country. Most of the dentists worked in private clinics or both private and public clinics.

Table 1 showing the use of Antithrombotic drugs in the last month

Antithrombotic drugs	Yes	No
Answers	48	22
Percentage	68.6	31.4

Have you treated patients with antithrombotic drugs (antiplatelet or anticoagulants) in the last month?

70 responses

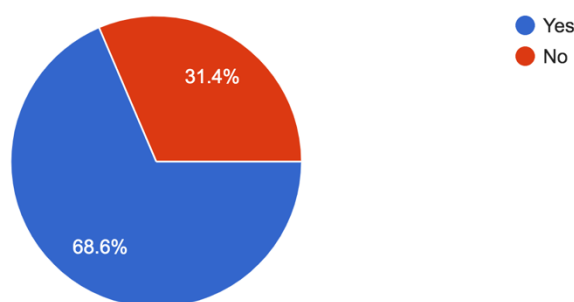


Figure 1 showing the percentage of Antithrombotic drug use by patients in the last month

A lot of dentists (68.6%) have treated patients who are taking antithrombotic drugs in the last month, and this demonstrates that many patients who come to the clinic are immunosuppressed and therefore precautions need to be taken to avoid medical emergencies occurring.

Many dentists (90%) claimed to record the medical history of their patients including previous medical conditions and drugs, while 10% do not, and this is important as it allows the dentists to have a correct understanding on whether special medical precautions must be taken prior, during or after treatment.

Almost all dentists (75.7%) stated that they can identify the differences between antiplatelet and anticoagulant drugs while 24.3% cannot. This is a drastically high number of dentists that

cannot recognise the difference between antiplatelet and anticoagulant drugs, especially since previously mentioned, 68.6% of these dentists have treated a patient taking antithrombotic drugs in the last month.

Table 2 showing how many dentists have called an ambulance for a patient

Ambulance	Yes	No
Answers	16	54
Percentage	22.9	77.1

Have you ever called an ambulance for a patient?

70 responses

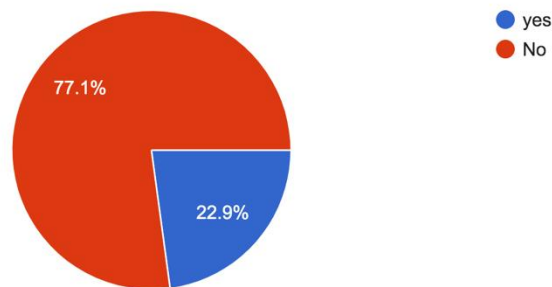


Figure 2 showing the percentage of dentists who have called an ambulance for a patient

A small percentage of the dentists (22.9%) who completed my questionnaire stated that they have called an ambulance for a patient due to them suffering from a medical emergency that the dentist or the other dental staff members were not able to treat or get under control. Luckily, 77.1% of the dentists have not called an ambulance for a patient which can either be due to the dentist getting control over the medical emergency before it becomes fatal or the patient not being at risk of suffering from a medical emergency.

Only 14.3% of dentists record every patient's blood pressure and heartrate while 85.7% do not. This does not have a major significance on the probability of a medical emergency occurring because these vital signs do not need to be measured in healthy patients who do not suffer from blood pressure disorders.

Table 3 showing the number of dentists who have witnessed different medical emergencies in the last 2 years

Medical Emergencies	Epilepsy	Hyper/hypotension	Chest pain	Cardiac Arrest	Anaphylaxis	Syncope	Diabetes	Respiratory arrest	Blood disorder
Answers	5	21	5	1	6	8	10	0	7
Percentage	7.9	33.3	7.9	1.6	9.5	12.7	15.9	0	11.1

Please mark the medical emergencies you have seen in a dental clinic in the last 2 years
63 responses

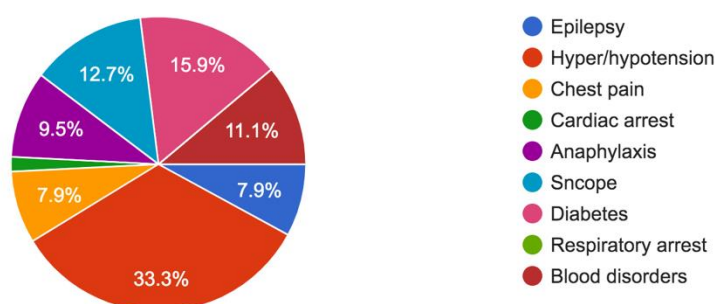


Figure 3 showing the percentage of the different medical emergencies witnessed by dentists in the last 2 years

Hypertension/hypotension crisis (33.3%) followed by diabetes (15.9%) and syncope (12.7%) were the most common medical emergencies seen by the dentists who completed my questionnaire in the last 2 years. Cardiac arrests (1.6%) were the least common after epilepsy (7.9%) and chest pain (7.9%).

Table 4 showing the frequency of medical emergencies witnessed by dentists

Medical Emergencies	Epilepsy	Chest pain	Cardiac arrest	Anaphylaxis	Syncope	Diabetes	Respiratory arrest
Numbers	5	4	7	1	15	19	11

Percentage	8.1	6.5	11.3	1.6	24.2	30.6	17.7
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What is the most frequent medical emergency you have witnessed?

62 responses

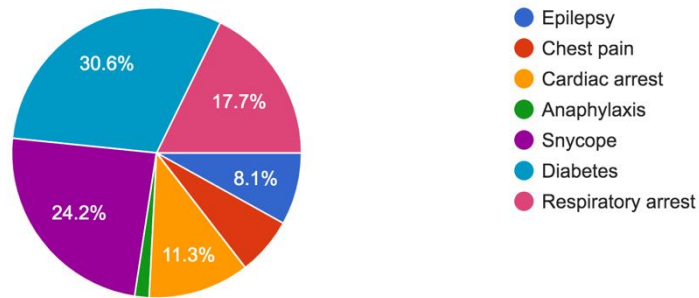


Figure 4 showing the percentage of the different medical emergencies that the dentists have witnessed

Syncope (24.2%) and diabetes (30.6%) are the most frequent medical emergencies seen by the dentists in their everyday work experience who completed my questionnaire while anaphylaxis (1.6%) and chest pain (6.5%) were the least common medical emergencies.

A large number of dentists (69.1%) claimed of feeling stressed when faced with a medical emergency and only 30.9% of dentists did not. This is mainly due to the excessive pressure dentists experience when their patient is no longer in their usual medical state. It becomes the dentist's duty to try and stabilise the patient before an ambulance arrives if necessary.

A few dentists (60%) have a supply of adrenaline/epinephrine in their dental clinic in case a patient has an anaphylactic shock, while 40% of dentists do not. This result is shocking, as adrenaline/epinephrine is the first line of action when a patient is having an anaphylactic shock and can save the patient's life.

Table 5 showing the number of dentists that have an external defibrillator in their dental clinic

Defibrillator	Yes	No
Answers	41	29
Percentage	58.6	41.4

Do you have an external defibrillator in your dental clinic?
70 responses

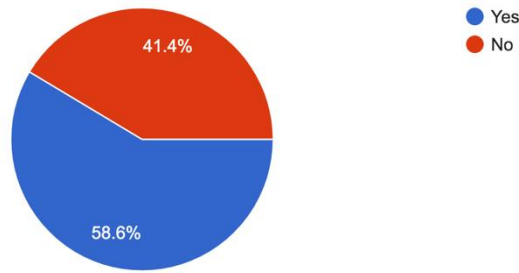


Figure 5 showing the percentage of dentists that have an external defibrillator in their dental clinic

A small number of dentists (41.4%) that completed my questionnaire do not have an external defibrillator in their dental clinic while 58.6% do. External defibrillators are used when the patient has a heart attack as it can give an electric shock to the patient to try and reactivate the patient's heartbeat. It is strongly advised to have an external defibrillator in a dental clinic to try and minimise fatal deaths.

Almost all the dentists (90%) have received cardiopulmonary resuscitation training which is important when the patient's heart stops beating. This training should be completed every few years to remind dentists on the correct protocol of action.

Many dentists (70%) said that they feel prepared to help a patient when a medical emergency occurs while 30% do not feel prepared. This may be due to them feeling stressed and under pressure to save a patient's life, as well as not being familiar with the medication used in an emergency. In addition, 84.8% have blood pressure monitors and a pulse oximeter to measure a patient's vital signs.

Many of the dentists (78.6%) believe that medical emergencies occur due to previous medical conditions, yet 21.4% say it is due to dental interventions such as the use of anaesthesia and 61.4% know how to administer intramuscular drugs while 52.2% know how to administer intravenous drugs to patients who need fast acting medication.

Just over half of the dentist (58%) who completed my questionnaire have a protocol in place to follow in case a medical emergency occurs while many dentists (42%) do not. This can help

to explain why 69.1% of dentists feel stressed when having to deal with a medical emergency. 80.9% stated that they see more medical emergencies in adults and 19.1% see more medical emergencies in children.

Table 6 showing when the last medical emergency occurred for the dentists

Medical emergency	Last week	Last month	Few months ago	1 year ago	5 years ago	More than 5 years ago
Numbers	7	8	17	27	1	6
Percentage	10.6	12.1	25.8	40.9	1.5	9.1

When was the last time you experienced a patient suffering from a medical emergency?
66 responses

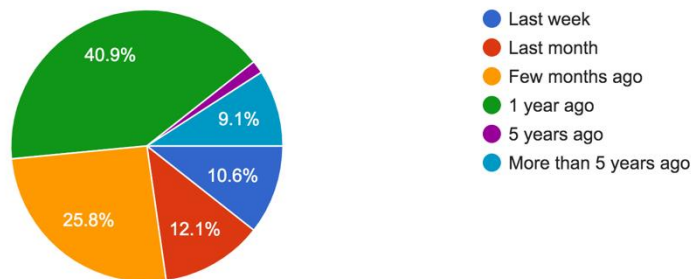


Figure 6 showing the percentage of when the last medical emergency occurred for the dentists

These results show that the majority of medical emergencies seen by dentists occurred 1 year ago (40.9%) which stresses the fact that medical emergencies occur quite frequently in dental clinics. 46.4% said that the dental nurses working in their clinic are trained to help in a medical emergency while a greater number of dentists (53.6%) said that their nurses are not trained.

IV. Discussion

IV.I Analysis

Due to the increase in life expectancy, the number of elderly patients with chronic illnesses has escalated. This is paired with a greater intake of medication and drug interactions with products used in a dental clinic, for example, anaesthesia. (7)

A survey was conducted in England to gain information on which medical emergency dentists encountered most often over a period of 12 months. Vasovagal syncope was the most prevalent (63%), followed by Angina (12%) and Hypoglycaemia (10%). A second survey was done in Germany that also found Vasovagal syncope to be the most common medical emergency. (8) Previous studies have shown that Vasovagal syncope, Hypertension, Epilepsy and Hypoglycaemia are the most frequent emergencies that dentists have encountered when completing their treatment, as it has been reported that a medical emergency in a dental practise will appear every 2 to 4 years. (7)

IV.II General Guidelines

There are 4 general guidelines created by the General Dental Council, that if followed, can minimise the risks of medical emergencies becoming terminal.

- At least 2 people should be present when treatment is taking place in case a medical emergency begins.
- All members of staff working in the dental clinic, not just the dentist, should know their role and the protocol in the event of an emergency.
- All members should be trained and prepared to deal with any medical emergency that may take place.
- Regular practise in a simulated setting to be reminded of the steps and the arrangements that the clinic has put into place.

46.4% of the dentists that completed my questionnaire stated that the dental nurses that they work with are trained to respond to medical emergencies. Having a dental nurse trained allows the dentist to have someone there to help them if needed. The dentist can feel a decrease in pressure and responsibility due to two people controlling the situation rather than one. Additionally, if the dentist gets overwhelmed and cannot respond to the patient, the assistant/dental nurse will be able to take over and try to help the patient stay calm and assess the cause of the medical emergency.

Other recommendations include:

- All dental professionals, when assessing an acute ill patient, should follow the ABCDE rule.
- Emergency drugs and medical equipment, including adrenaline or a resuscitation kit, should be available and accessible to dental professionals.
- Dental practitioners should have completed CPR training with annual updates.
- A protocol should be put into place for dentists and other healthcare workers to follow to reduce the incidence of a medical emergency occurring, and if it does occur, to limit the likelihood of it becoming fatal. (6)
- The drugs kept in a dental facility should have the capability to have life saving measures within the first 15-20 minutes after a medical emergency before further help arrives such as an ambulance.
- The dentist should be able to administer the necessary drugs orally, sublingually, or the intramuscular route. (9)

IV.III Management

Epilepsy/Seizures

Seizures that continue for a prolonged period or are repeated often, are considered a medical emergency and therefore dental practitioners should be able to manage and treat them when necessary. The main course of action is administering Midazolam buccally as the first action of treatment both in adults and children. (10) If a dentist encounters a patient who is having an epileptic fit, the dentist must remove any objects in the surrounding that may cause further damage to the patient such as anaesthesia needles or other sharp objects. Additionally, the

dentist should attempt to remove the rubber dam from the patient's mouth and have them lying down in the dental chair with an assistant standing close in case the patient needs assistance staying on. If the seizure lasts more than 5 minutes, a dental practitioner should call an ambulance since a dental clinic does not have the correct facilities and equipment to treat the patient.

After evaluating my questionnaire, it is seen that 7.9% of dentists experienced a patient having an epileptic fit within the past 2 years and 8.1% said it was the most frequent medical emergency they have seen during their working experience. This demonstrates that although seizures are not the most common medical emergency, dentists must be familiar with the protocol of action to treat an epileptic patient.

Effects of local anaesthetics

Anaphylactic shocks after administering local anaesthetics are considered a fatal dental emergency. Anaphylaxis is explained as 'an acute potentially life-threatening hypersensitivity reaction' and have initial symptoms of a warm itchy sensation followed by anxiety and panic. (11) Dentists must do an in-depth analysis on the patient's medical history to see if they are prone to suffering a cardiovascular disease. Local anaesthetics usually contain vasoconstrictors such as Epinephrine to increase the duration of the anaesthetic and better the soft tissue haemostasis, however, when given in high doses or when injected into an extremely vascular area, it can trigger adverse cardiovascular effects. On that account, it is highly recommended to use the lowest effective concentration of Epinephrine in patients with cardiovascular disease. (12) A report found that 4.3 per 10,000 cardiac arrests were due to anaesthesia being the triggering cause. (13)

If the patient is suspected of suffering an anaphylactic shock, there are a sequence of steps to be followed:

- Stop procedure, clear away material and any other potential triggers.
- Place patient in a supine position, especially if the patient is struggling to breathe as one of the side effects of an anaesthetic anaphylactic shock.
- Administer intramuscular adrenaline (0.3mg for adults and 0.15mg for children).
- Call an ambulance and give the patient oxygen at a rate of 6-8L/min.

- Monitor the patient's vital signs and readminister adrenaline every 5 minutes, if necessary, until the ambulance arrives.

Local anaesthetics have been modified by reducing the number of added preservatives such as sulfites to diminish the probability of an allergic reaction to the anaesthesia. (6)

Before, during, or after dental treatment, adrenaline can be given intravenously to stop the anaphylactic shock. However, 40% of the dentists that completed by questionnaire have stated that they do not have adrenaline/epinephrine in their dental clinic. This highlights the importance of having these medications stocked in the dental clinics as it is a necessity to save a patient's life when they are in danger.

Medically Compromised Patients

Dentists will come across a patient with cardiac disease during their working experience and it is often recommended for the patient to use their glyceryl trinitrate spray before attending their appointment if they suffer from angina. If the patient requires oral surgery during their treatment plan, they should be treated in the late morning or early afternoon with a short appointment when their levels of catecholamines are lower. Patients who also suffer from elevated blood pressure (more than 160/100 mmHg) should have a medical consultation with their health doctor prior to any treatment to control their blood pressure. Midazolam is a recommended drug to be taken as it lowers the patient's blood pressure during oral surgery and the blood pressure should be recorded throughout treatment in case it gets too high the dentist can terminate the treatment. It has been stated that patients with cardiac failure should not be positioned fully supine in the dental chair due to the increased chance of becoming breathless (orthopnoea). A significant amount of hypertensive medication can bring about postural hypotension when going from a lying down position to a standing position and should therefore be managed by the dentist. (14) The patient's anxiety levels can also trigger a medical emergency such as hyperventilation which can occur in the waiting room or during their appointment, therefore all members of staff should be aware of their surroundings and know the protocol of action. (15)

41.4% of the dentists that completed my questionnaire do not have an external defibrillator in their dental clinic. External defibrillators are used when the patient has a heart attack and

their heart stops pumping blood around their body. Constant cardiopulmonary resuscitation (CPR) can be given to the patient until an ambulance arrives, however it can become very tiring on the dentist. Nevertheless, an external defibrillator can give an electric shock to the patient in order to try and reactivate the patient's heartbeat alongside CPR which can increase the patient's chances of surviving this type of medical emergency. It is strongly advised to have an external defibrillator in a dental clinic to try and minimise fatal deaths.

Respiratory diseases such as asthma and chronic obstructive pulmonary disease are frequently encountered in a dental clinic. Patients with asthma should be told to bring their inhalers with them to their appointments and should be used prior to attending their consultation. Post treatment medication such as NSAIDs and aspirin should be avoided in sensitive patients as it may induce an asthma attack.

Diabetic patients are at risk of suffering from hypoglycaemia, so for that reason, they should be given appointments early in the morning to prevent an interruption with their mealtimes or insulin regimes. On top of that, the patient's glucose levels must be checked, and if within the range of 5.0-15.0 mmol/L, treatment can be continued. If below 5.0 mmol/L, oral glucose can be given, and treatment may be postponed until glycaemic levels are controlled. Diabetic patients are more probable to suffering from an infection and therefore antibiotic prophylaxis is recommended. All dentists must be familiar with the signs and symptoms of a hypoglycaemic attack and should have the knowledge and expertise to manage it as a medical emergency. (14) 33.3% of the dentists that completed my questionnaire stated that hyper/hypotension crisis was the most frequent medical emergency seen in the last two years followed by diabetes (15.9%).

Diabetes was the most frequent medical emergency witnessed by the dentists as 30.6% claimed it to be the most frequent medical emergency that occurred in their dental clinic. This may be due to multiple factors such as the patient not being aware they suffer from diabetes, the patient not eating before their appointment, or the patients high stress and anxiety levels before and during their appointment. The dentists must therefore ask the patient if they suffer from anxiety, and if they do, anti-anxiolytic medication can be given before their appointment such as Benzodiazepines.

Drug use

Dental clinics should be equipped with a drug kit that should be stored in an accessible area for all dentists and dental assistants and should be checked regularly for expiration dates. The kit should contain Epinephrine for severe allergic reactions with a dose of 0.3 mg for adults and 0.15 mg for children by an intramuscular injection. If a mild allergic reaction occurs, a tablet of 25 mg Diphenhydramine can be given to children or 50 mg for adults. Albuterol can be inhaled by the patient if they start suffering from bronchospasm either due to an allergic reaction or an asthmatic episode. (16)

60% of the dentists that completed my questionnaire said that they have adrenaline/epinephrine in their dental clinic. These drugs are considered to be part of the basic drug kit that dental clinics are recommended to have. In my questionnaire, I asked dentists whether they are familiar with the differences between antiplatelet and anticoagulant drugs and if they can identify drugs such as Clopidogrel, and 75.7% said yes while 24.3% said no. This highlights that dentists need to be educated on the different drugs that patients might be taking as it can alter the treatment plan accordingly.

The Resuscitation Council (UK) has a list of standardised drugs that dental clinics should have in case of an emergency. These include: (17)

- Oxygen – inhalation
- Glycerol Trinitrate spray 400 micrograms – sublingual
- Dispersible aspirin 300 mg – oral chewed
- Salbutamol aerosol inhaler 100 micrograms – inhalation
- Adrenaline – intramuscular
- Glucagon injection 1 mg – intramuscular/subcutaneous
- Oral glucose solution/gel - oral
- Midazolam 10 mg – topical

If oxygen is required for the patient, dental clinics must have an oxygen source such as resuscitation bags for patients who are spontaneously breathing but need a little more support. However, patients who are unconscious and need oxygen to reach their brain, oxygen face masks are used and are pumped manually by the dentist or the dental assistant until further help arrives such as an ambulance. (18)

Simulation

Many dentists feel stressed when confronted with a medical emergency which is demonstrated in my results where 69.1% of dentists who completed my questionnaire stated feeling stressed. Simulation programmes have been introduced in an attempt to decrease stress levels and educate dentists and other members of staff on how to handle a medical emergency when it arrives.

The programme consists of 3 components: reading, hands on workshop, and simulation training. The simulation embodies the use of oxygen masks, glucose, Epi-pens, and an automatic external defibrillator. It also informs the participants on how to do correct CPR on a patient by practising on a dummy that is attached to a software. This software gives immediate feedback and a visual representation of their performance depth and compression rate as well as correct hand position. (19)

It is also important for dentists to know the protocol when faced with patients from different age groups. Memorising the doses/formulas of medication depending on a patient's age, weight, and height can save a patient's life due to time saving knowledge. (20) (21)

90% of the dentists that completed my questionnaire had received CPR training which emphasises the importance on CPR simulation training as dentists will be faced with a medical emergency that can deteriorate and put the patient into a fatal state. Furthermore, 30% of the dentists voiced that they do not feel prepared to help a patient in a medical emergency. This may be due to them feeling stressed and under pressure to save a patient's life, as well as not being familiar with the medication used in an emergency. Therefore, this emphasises the importance of having a protocol in place with step by step guidance on what to do depending on the different medical emergencies that can occur in a dental clinic as it provides the dentist with reassurance. 69.1% of the dentists stated that they feel stressed when confronted with a medical emergency.

Medication prescription after appointment

A study done in 2015-2017 by the National Hospital Ambulatory Medical Care found that almost 74% of patients were prescribed an analgesic and 54% of patients were given antibiotics before/after their appointment. (22) Opioid prescriptions are common in dental

patients due to the urgent pain related visits and due to the anaesthesia wearing off after their appointments, however it has been acknowledged that antibiotics are being prescribed when they are not necessary and can be doing harm to the patient instead of preventing or treating infections. A study was done by the General Dental Council and found that antibiotics given as treatment for local infections was not appropriate. Some dentists may prescribe antibiotics, when it is unnecessary, due to their poor understanding on the pathological reasons for an infection present in the mouth. (23)

78.6% of dentists who completed my questionnaire said that most medical emergencies are due to previous medical conditions. This can be due to a few things such as the patient not taking their medication correctly, patient not informing the dentist on their health issues, and the dentist not taking the correct precautions specified to each patient.

Avoiding medical emergencies

Taking and monitoring a patient's temperature, blood pressure, pulse, oxygen saturation and respiratory rate are fundamental to assess the severity of the patient's medical emergency status and decide what further actions need to be taken.

- Temperature of the patient is taken using an under-the-tongue thermometer.
- Blood pressure is taken using a blood pressure monitor.
- Pulse can be taken manually at the carotid pulse, or from a pulse oximeter.
- Oxygen saturation measured with a pulse oximeter.
- Respiratory rate is measured by looking at the patient's chest and counting the number of breathes.
- Level of consciousness should be examined to determine if the patient is responsive or unresponsive. (24)

Treatment plans should often be discussed amongst the dentists working in the clinic in case some information is missed by the dental practitioner treating the patient. The medical history of each patient should be checked prior to treatment before every appointment to see if any changes have been made since their last visit to the dental clinic.

If the patient's temperature is above the normal value of 37 degrees Celsius, it may be a strong indicator to an infection in the body either viral or bacterial. An increase in pulse and

respiratory rate might be due to anxiety and can lead to hyperventilation. That being the case, it has been noticed that the best way to handle a medical emergency is to be prepared in advance with frequent attendance to dental education programs and hands-on courses in the dental field. (25)

90% of the dentists that completed my questionnaire record the medical history of each patient that attends their clinic. This is a fundamental step in avoiding medical emergencies as the dentist will have a complete understanding of the patient they are about to treat and can therefore take the necessary precautions. However, 22.9% of the dentists stated that they have called an ambulance for a patient due to the patient suffering from a medical emergency that the dentist or other dental staff could not treat or get under control. Recording a patient's blood pressure and heart rate is not necessary in every patient, however, 14.3% of the dentists claimed to measure these vital signs in every patient. If the patient suffers from hyper/hypotension, then the blood pressure should be measured before starting treatment to limit the likelihood of experiencing a medical emergency.

V. Statement of Originality

I, Atasha Tiba Ardehali Fard, with student number 21700594, declare that I am the author of the final degree project entitled Medical Emergencies in Dental Clinics. A descriptive study based in questionnaires to dentists, which I am submitting in fulfilment of my studies for the Degree of Dentistry at the Faculty of Biomedical and Health Sciences of the European University of Madrid, and I declare the following (i) that the work presenting is original and unpublished, being the result of my own intellectual contribution; (ii) that the figures, tables and illustrations contained in the work are accurate representation, without digital alteration, for which I undertake to respond to any inconsistencies or inaccuracies that may exist in them; (iii) I assure that I have correctly identified and referenced all the information contained in the text and bibliographical references of the work, which has been obtained from previously published sources, guaranteeing honesty and integrity in the preparation of this academic document.

For the record, this declaration of originality is signed in Madrid, at Thursday 13th April 2023.

Atasha Tiba Ardehali Fard

VI. Conclusion

1. The most frequent medical emergency to occur in a dental clinic is hyper/hypotension crisis, followed by diabetes and vasovagal syncope.

2. Medical emergencies can be handled in multiple ways in a dental clinic. One very efficient way is ensuring all members of the dental clinic are informed on the protocol in which to follow when faced with a medical emergency and have regular simulated sessions to improve their knowledge on the best ways to react to a medical emergency. In addition, recording the patient's medical history and assessing their vital signs before, during, and after an appointment if the patient is medically compromised can reduce the possibility of a medical emergency occurring.

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Appendix 1: English survey

Medical Emergencies in The Dental Clinic

Informed Consent: I understand that this is an anonymous questionnaire to practicing dentists and I authorize the use of the data with the only purpose of the Final Degree Project that is being done in the Dentistry Faculty of the Universidad Europea, Madrid, Spain, under the supervision of Prof. Martínez-Sellés

What country do you work in?

Spain

England

France

Sweden

Other (please specify)

Do you work in a public or private clinic?

- Public
- Private
- Both

Have you treated patients with antithrombotic drugs (antiplatelet or anticoagulants) in the last month?

- Yes
- No

Do you record the medical history of your patients including previous medical conditions and drugs?

- Yes
- No

Are you aware of the difference between antiplatelet and anticoagulants and are you able to identify the following drugs: Clopidogrel, Apixaban, Acenocumarol?

- Yes
- No

Have you ever called an ambulance for a patient?

- yes
- No

Do you record blood pressure and heart rate in most of your patients?

- Yes
- No

Are you not only a dentist but also a medical doctor?

- Yes
- No

Please mark the medical emergencies you have seen in a dental clinic in the last 2 years

- Epilepsy
- Hyper/hypotension
- Chest pain
- Cardiac arrest
- Anaphylaxis
- Syncope
- Diabetes
- Respiratory arrest

What is the most frequent medical emergency you have witnessed?

- Epilepsy
- Chest pain
- Cardiac arrest
- Anaphylaxis
- Syncope
- Diabetes
- Respiratory arrest

When a medical emergency occurs do you feel stressed?

- Option 1
- No

Do you have adrenaline/epinephrine in your dental clinic?

Yes

No

Do you have an external defibrillator in your dental clinic?

Yes

No

Have you had cardiopulmonary resuscitation (CPR) training?

Yes

No

Do you feel prepared to help a patient in a medical emergency?

Yes

No

Do you know the normal values of blood pressure and heart rate?

Yes

No

What medical devices do you have in your clinic?

Blood pressure monitor

Pulse oximeter

Do you think that most medical emergencies in a dental clinic are mainly related with previous medical conditions or with dental interventions?

- Previous medical conditions
- Dental interventions

Can you administer intramuscular drugs?

- Yes
- No

Can you administer intravenous drugs?

- Yes
- No

Does the clinic where you work most of the time have a protocol on what to do when a medical emergency occurs?

- Yes
- No

Do you see more medical emergencies in children or adults?

- Children
- Adults

When was the last time you experienced a patient suffering from a medical emergency?

- Last week
- Last month
- Few months ago
- 1 year ago
- 5 years ago
- More than 5 years ago

Do you have a dental specialisation?

- Yes
- No

If yes, are you a?

- Implantologist
- Orthodontist
- Endodontist
- Other (please specify)

Are your dental nurses trained to respond in a medical emergency?

- Option 1
- No

