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This article counts towards one of the five core subjects introduced in 2007 by the GDC.

Medical Emergencies in Dental Practice: 1. The Drug Box, Equipment and General Approach

Abstract: Every dental practitioner needs a knowledge of the diagnosis and management of medical emergencies. This first paper, in a series of two, deals with the general aspects of emergency treatment, including basic principles applicable to all emergencies and a consideration of the management of cardiac arrest. The second paper deals with more specific aspects of medical emergency management.
Clinical Relevance: All dental practitioners require a knowledge of medical emergency management.
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Medical emergencies in dental practice are uncommon but could occur at any time. It is important, however, that dental practitioners are proficient in recognizing them and carrying out initial management of such emergencies. The commonest emergencies seen include the following:

- Faints;
- Hypoglycaemia;
- Asthma attacks;
- Anaphylaxis;
- Angina; and
- Seizures.

Examples of such events have been reported to occur on average once every 3–4 years per dentist.[1]

All members of the dental team need to be aware of what their role would be in the event of a medical emergency and should be trained appropriately with regular practise sessions.

Successful patient management begins with anticipation of the more likely potential medical emergencies that could arise by taking a thorough medical history. If a medical condition is identified

Drug	Route of Administration
Oxygen	Inhalation
Glyceryl trinitrate (GTN) spray (400 micrograms per actuation)	Sublingual
Dispersible aspirin (300 mg)	Oral (chewed)
Salbutamol aerosol inhaler (100 micrograms per actuation)	Inhalation
Adrenaline injection (1:1000, 1 mg/ml)	Intramuscular
Glucagon injection (1 mg)	Intramuscular/subcutaneous
Oral glucose solution/gel (GlucoGel®)*	Oral
Midazolam 10 mg or 5 mg/ml (buccal or intranasal)	Infiltration/inhalation
*Alternatives: 2 teaspoons of sugar/3 sugar lumps 200 ml milk Non-diet Lucozade® 50 ml Coca-cola® non-diet 90 ml If necessary this can be repeated at 10-15 minute intervals.	

Table 1. Contents of the emergency drug box and routes of administration.

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Figure 1. A 'Glucagon kit' with water for dilution already drawn up and powder for reconstitution. Kits such as these can save valuable time in managing emergencies, in this case hypoglycaemia.

Figure 2. An oropharyngeal airway.

- Portable oxygen cylinder (D size) with a flowmeter and pressure reduction valve
- Oxygen face mask with tubing
- Oropharyngeal airways –sizes 1, 2, 3 and 4 (Figure 2)
- Pocket mask with port for oxygen – Figure 3
- Bag and mask apparatus (1 litre bag capacity) with oxygen reservoir
- Well-fitting face masks
- Portable suction
- Single-use sterile syringes and needles
- 'Spacer' device for inhaled bronchodilators
- Blood glucose measurement device
- Automated External Defibrillator (AED) – Figure 5

Table 2. Suggested minimum equipment for medical emergency management (adapted from Resuscitation Council (UK)).

and medication is normally taken, a check should always be made to ensure that the medication has been taken as usual.

The management of specific medical emergencies is considered in the second paper. This paper considers more general aspects with regard to management, together with the management of cardiac arrest.

Contents of the emergency drug box

Medical emergencies may require equipment, drugs or both in order to manage them effectively. If these are unavailable, patients should not be treated. It is also important to check that the drugs are within their expiry date.

Drugs to be included in the emergency drug box are summarized in Table 1. The list is based on that given in the Resuscitation Council (UK) document on Medical Emergencies and Resuscitation in Dentistry.[2]

The Resuscitation Council (UK) recommends that such kits should be standardized throughout the United Kingdom.[2] Wherever possible, drugs in solution should be carried in a pre-filled syringe or kit (Figure 1). All drugs should be stored together, ideally in a purpose-designed container.

The optimum route for delivery of emergency drugs is usually the intravenous route but dentists are often inexperienced with this route of delivery. Formulations have now been developed that allow for other routes to be used which are much quicker and user-friendly and the intravenous route for emergency drugs is no longer recommended for dental practitioners. Oxygen should always be available, deliverable at adequate flow rates (10 litres per minute).

Equipment for use in medical emergencies

The Resuscitation Council (UK) have recommended as a minimum the equipment shown in Table 2.[2] Named individuals should be nominated to check equipment. This should be carried out at least weekly and the process should be audited.

The use of the items of equipment listed in Table 2 will be discussed in the second paper. It is a public expectation that Automated External Defibrillators (AEDs) should be available in the healthcare environment and dentistry is not considered an exception.[2] All emergency medical equipment should be latex-free and single use wherever possible.

Staff training

Staff should be trained in the management of medical emergencies to a degree which is appropriate to their level of clinical responsibility. Skills should be updated on an annual basis. It is important that new members of staff have medical emergency training incorporated into their induction programme. A full record should be kept of training. Staff should know who to contact in the event of help being required and designated emergency phone numbers (usually 999) should be readily available.

The 'ABCDE' approach to an emergency patient

Medical emergencies can

A	**A**irway
B	**B**reathing
C	**C**irculation
D	**D**isability (or neurological status)
E	**E**xposure (in dental practice, to facilitate placement of AED paddles) or appropriately exposing parts to be examined

Table 3. The **ABCDE** approach to an emergency patient.

Figure 3. Pocket mask with a port for oxygen.

often be prevented by early recognition. An abnormal patient colour, pulse rate or breathing can signal some impending emergencies.

It is important to have a systematic approach to an acutely ill patient and to remain calm. The principles are summarized in the '**ABCDE**' approach (Table 3). These aspects will be considered in turn but it is useful to start with a brief discussion of some general points.

Ensure that the environment is safe. It is important to call for help at a very early stage – this includes anything from other members of the dental team to calling for an ambulance. Continuous reappraisal of the patient's condition should be carried out and the airway must always be the starting point for this. Without appropriate oxygen delivery, all other management steps will be ultimately futile. It is important to assess the success or otherwise of manoeuvres or treatments given, bearing in mind that treatments may take time to work.

If the patient is conscious, ask him/her how they are. This may give important information about the problem (for example, the patient who cannot speak or tells you that they have chest pain). If the patient is unresponsive, the patient should be shaken and asked 'Are you alright?'. If they do not respond at all, have no pulse and show no 'signs of life' they have had a cardiac arrest and should be managed as described later. 'Signs of life' refers to breathing and circulation (see later). They may respond in a breathless manner and should be asked 'Are you choking?'.[3]

Airway (A)

Airway obstruction is a medical emergency and must be managed quickly.

- Inability to complete sentences or speak
- 'Paradoxical' movement of chest and abdomen ('see-saw' respiration)
- Use of accessory muscles of respiration
- Blue lips and tongue (central cyanosis)
- No breathing sounds (complete airway obstruction)
- Stridor (inspiratory) – obstruction of larynx or above
- Wheeze (expiratory) – obstruction of lower airways, eg asthma or chronic obstructive pulmonary disease
- Gurgling – suggests liquid or semi-solid material in the upper airway
- Snoring – the pharynx is partly occluded by the soft palate or tongue

Table 4. Signs of airway obstruction.

Usually, a simple method of clearing the airway is all that is needed. A head tilt, chin lift or jaw thrust will open the airway. Patients who are unable to speak are in need of urgent attention and establishing a patent airway is vital. It is important to remove any visible foreign bodies, blood or debris and the use of suction may be beneficial. Clearing the mouth should be done with great care using a 'finger sweep' in adults to avoid pushing material further into the upper airway. Simple airway adjuncts, such as an oropharyngeal airway (Figure 2), may be used. An impaired airway may be recognized by some of the signs and symptoms summarized in Table 4.

It is important to administer oxygen at high concentration (10 litres per minute) via a well-fitting face mask with a port for oxygen (Figure 3). Even patients with chronic obstructive pulmonary disease who retain carbon dioxide should be given a high concentration of oxygen. Such patients may depend on hypoxic drive to stimulate respiration but, in the short-term, a high concentration of oxygen will do no harm, so its avoidance in an acute situation is unnecessary.

Breathing (B) and Circulation (C)

A clinician should look, listen and feel for signs of respiratory distress. This should be done whilst keeping the airway open and the clinician should:

- Look for chest movement;
- Listen for breath sounds at the victim's mouth;
- Feel for air on the rescuer's cheek with the rescuer's head turned against the patient's mouth;
- This should be done for no more than 10 seconds to determine normal breathing;
- If there is any doubt as to whether breathing is normal, action should be as if it is not normal, ie commence cardiopulmonary resuscitation (CPR).

A victim may be barely breathing or gasping in the first few minutes after cardiac arrest and this should not be mistaken for normal breathing. Agonal gasps refer to abnormal breathing present in up to 40% of victims of cardiac arrest. CPR should therefore be carried out if the victim is unconscious (unresponsive) and not breathing normally. Agonal gasps should not delay the start of CPR as they are not normal breathing.

If the collapsed patient is breathing normally

- He/she should be turned into the recovery position (essentially on his/her side – best learnt as a practical exercise);
- Send for help or call for an ambulance;
- Ensure that breathing continues.

If the patient is not breathing normally

- Ensure an ambulance is summoned (may necessitate leaving the victim) but, in a dental setting, the practitioner should not be working alone;
- Start chest compressions:

– kneel at the side of the victim;
–place the heel of one hand in the centre of the victim's chest and the other hand on top of the first hand – it will usually be possible to do this without removing the victim's clothes. If there is any doubt, outer clothing should be undone/removed;
– interlock the fingers of both hands – do not apply pressure over the ribs, upper abdomen or the lower end of the sternum;
– the rescuer should be positioned vertically above the victim's chest. With

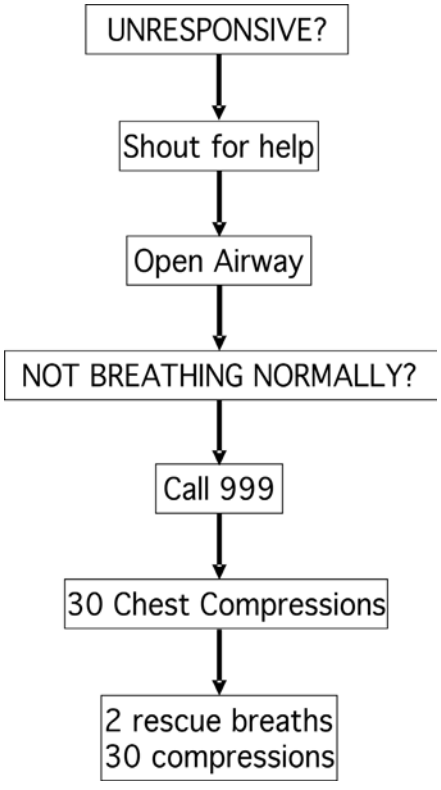

Figure 4. Algorithm for Basic Life Support in an adult patient (from Resuscitation Council UK).

Signs
- Are the patient's hands blue or pink, cool or warm?
- What is the capillary refill time?*
- Pulse rate (carotid or radial artery), rhythm and strength.

Symptoms
- Is there a history of chest pain/does the patient report chest pain?

*If pressure is applied to the finger nail to produce blanching, the colour should return in less than 2 seconds in a normal patient. Remember that local causes such as a cold environment could also delay the response.

Table 5. Simple methods of circulatory assessment.

straight arms the sternum should be depressed 4–5 cm;
– after each compression all the pressure should be released so that the rib cage recoils to its rest position but the hands should be maintained in contact with the sternum;
– the rate should be approximately 100 times per minute (a little less than 2 compressions per second).
- After 30 compressions, the airway should be opened using head tilt and chin lift and 2 rescue breaths should be given. This may be carried out using a bag and mask or mouth-to-mouth (with the nostrils closed between thumb and index finger) or mouth-to-mask.
- Practical skills are best learnt on a resuscitation course but certain principles are given below:
– inflations should make the chest rise. About 1 second should be taken to do this;
– the chest should be allowed to fall whilst maintaining the airway. Two rescue breaths should be given;
– hands should be returned to the sternum without delay to continue the chest compressions in a ratio of 30:2.
- Only stop to recheck the patient if normal breathing starts, otherwise resuscitation should be continuous until:
– qualified help takes over;
– the rescuer becomes exhausted.

If rescue breaths do not make the chest rise
- Check for visible obstruction in the mouth and remove if possible;
- Make sure that the head tilt and chin lift are adequate;
- Do not waste time attempting more than two breaths each time before continuing chest compressions.

Carrying out these manoeuvres is tiring and, if there is more than one rescuer, CPR should be alternated between them every 2 minutes. The algorithm for adult basic life support is given in Figure 4.

Factors to consider in assessing circulation (C)

Circulatory assessment should never delay the start of CPR. Simple observations to make a gross assessment of circulatory efficiency are given in Table 5. By far the most common cause of a collapse that is circulatory in origin is the simple faint (vaso-vagal syncope). A rapid recovery can be expected in these cases if the patient is laid flat and the legs raised. Prompt management is required, however, as cerebral hypoxia has devastating consequences if prolonged. Other causes than a faint must be considered if recovery does not happen promptly.

It has been found that checking the carotid pulse to diagnose cardiac arrest can be unreliable, even sometimes when attempted by some healthcare professionals.[4]

Checking the carotid pulse should only be carried out by those proficient in doing this. The latest guidelines highlight the need to identify agonal gasps (as well as the absence of breathing) as a sign to commence CPR and lay no particular emphasis on checking the carotid pulse.

Once A, B and C are secured, persisting problems should be considered by an appraisal of 'D and E', below, particularly if the patient is still compromised.

Disability (D)

Disability is the term which refers to an assessment of the neurological status of the patient. In this context, primarily, it refers to the level of consciousness (in trauma patients a more widespread neurological examination is required). Hypoxia or hypercapnia (increased blood levels of carbon dioxide) are possible causes, together with certain sedative or analgesic drugs.

It is important to exclude hypoxia or hypotension and attention to the airway, giving supplemental oxygen and supporting the patient's circulation (by lying them supine and raising their legs) will in many cases solve the problem. All unconscious patients who are breathing and have a pulse should be placed in the recovery position if they are unable to maintain their own airway.

A rapid gross assessment can be made of a patient's level of consciousness using the **AVPU** method:
- Are they **A**lert?
- Do they respond to **V**ocal stimuli?

- Arrhythmia (most common type ventricular fibrillation or VF)
- Myocardial infarction (may lead to an arrhythmia)
- Choking
- Bleeding
- Drug overdose
- Hypoxia

Table 6. Possible causes of cardiac arrest.

Figure 5. An Automated External Defibrillator (AED).

- Do they respond to **P**ainful stimuli? or
- Are they **U**nresponsive?

A lapse into unconsciousness may be due to hypoglycaemia – if the blood glucose level is less than 3mmol/litre as checked by a glucose measuring device (Table 2) then glucagon should be given (see second paper in this series).

Exposure (E)

Exposure refers to loosening or removal of some of the patient's clothes. For example, for the application of defibrillator paddles (in dental practice), or if the patient has been involved in a traumatic incident (usually in hospital), for examination purposes. It is important to bear in mind the patient's dignity as well as the potential for clinically significant heat loss.

Cardiac arrest – other considerations

Cardiac arrest can occur for a variety of reasons which are summarized in Table 6.

It has been suggested[5] that cardiopulmonary resuscitation can be performed effectively in the dental chair, but it should always be confirmed that this is the case.

Interruptions to chest compression in resuscitation are common and are associated with a reduced chance of survival.[6] The ideal situation is to be able to deliver continuous chest compressions whilst giving ventilations independently. This is only possible, however, when an advanced airway is placed. Chest compression-only CPR is another way to increase the number of compressions but is only effective for a period of about five minutes.[6] For this reason this technique is not recommended. The principle on which compression only CPR works is that, during the first few minutes after a non-asphyxial cardiac arrest, the blood oxygen content remains high and therefore, at this stage, ventilation is less important than chest compression.

Use of defibrillation

Defibrillation is the term which refers to the termination of fibrillation. It is achieved by administering a controlled electrical shock to the heart which may restore an organized rhythm, enabling the heart to contract effectively. It is now well recognized that early defibrillation is important. Ventricular fibrillation (VF) is the most common cause of cardiac arrest. It is a rapid and chaotic rhythm and, as a result, the heart is unable to contract effectively and unable to sustain its function as a pump. The only effective treatment for VF is defibrillation, and the sooner the shock is given, the greater the chance of survival.[7]

The provision of defibrillation has been made easier by the development of AEDs (Figure 5). AEDs are sophisticated, reliable, safe, computerized devices which use voice and visual prompts to guide rescuers and are suitable for use by lay people and healthcare professionals.[8] The device analyses the victim's heart rhythm, determines the need for a shock and then delivers a shock. The AED algorithm is given in Figure 6. CPR should not be interrupted/delayed to set up the AED.

Placement of AED pads

Use of the AED is a skill which requires practical training and experience. The victim's chest must be sufficiently exposed. Excessive chest hair can stop the pads adhering properly and, if this is markedly the case, must be rapidly removed if possible. Razors are available in AED kits. Resuscitation should never be delayed for this reason, however.

One pad should be placed to the right of the sternum below the clavicle. The other pad should be placed in the left side mid-axillary line, centred on the fifth intercostal space. This electrode works best if orientated vertically. This position should be clear of any breast tissue. Although most AED pads are labelled or carry a picture of their position, it does not matter if they are reversed. Once familiarity with this item of equipment is achieved, its use is simple.

Principles of management after the initial treatment of a medical emergency

An ambulance should be called at the earliest opportunity as part of the management of any significant medical event. If the dental practitioner feels competent and confident that the emergency has been managed satisfactorily, and the patient is stable, they should still not be allowed to leave the dental practice unaccompanied or be allowed to drive a motor vehicle. The decision will be easier to take in some circumstances than others. For example, the patient who has an angina attack in

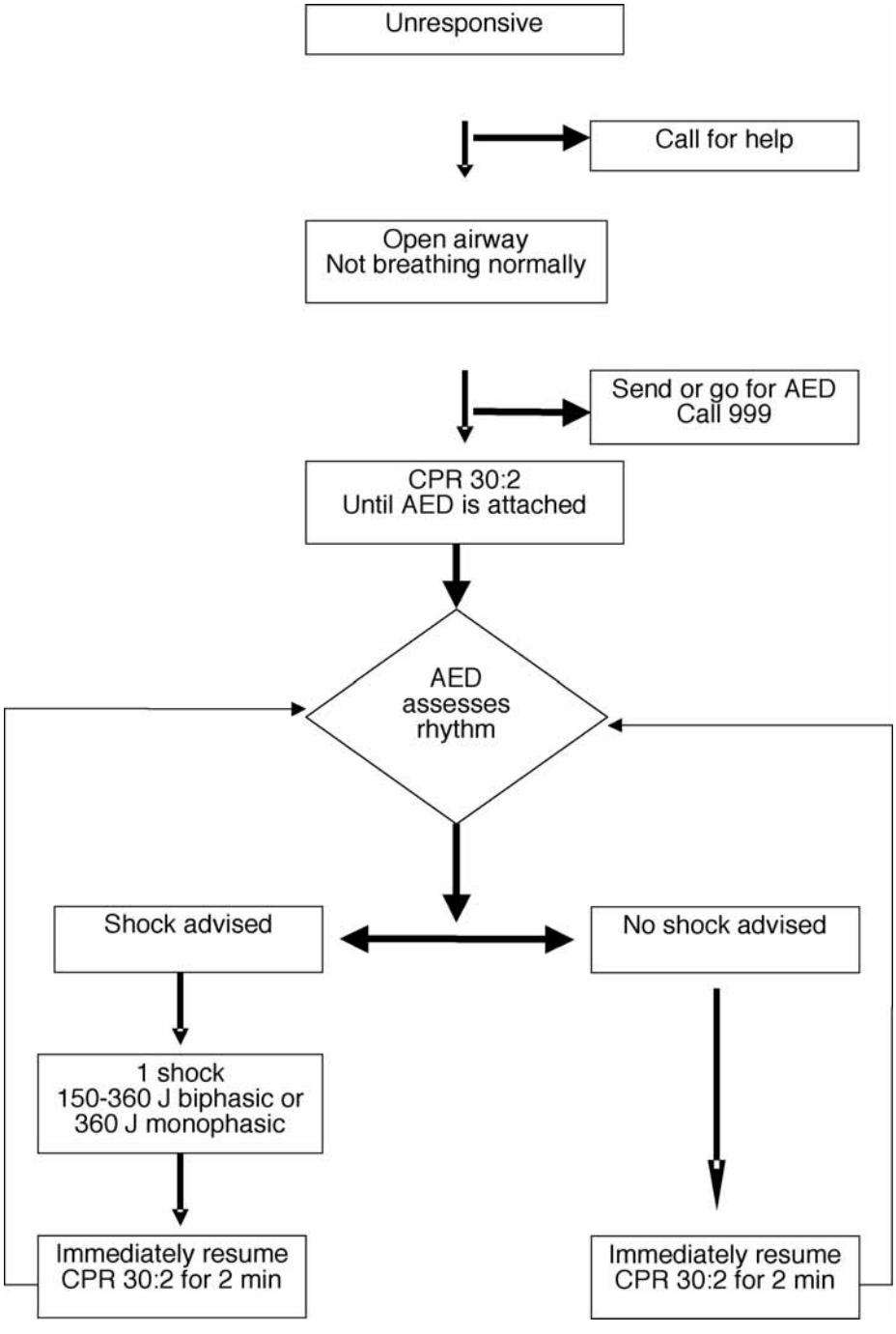

Figure 6. Automated External Defibrillator (AED) algorithm. Continue until victim able to breathe normally (Resuscitation Council UK).

the surgery, responds very quickly to their normal GTN, and who has a clear history of similar episodes and makes a complete recovery, will usually be well enough to be allowed home.

If a patient remains unwell, or there is any doubt at all, they should undergo assessment by a medical practitioner. Before any transfer is made, the patient's condition should be stabilized as long as that does not delay ongoing treatment. It is important that a written summary is given to the receiving team so that treatment that has been undertaken is made clear. A good example is documenting the fact that a patient has been given aspirin or undergone dental surgery, making them prone to haemorrhage, which may influence the decision to give antithrombolytic therapy.

Summary

Medical emergencies in dental practice are not common but could occur at any time. Such events are less alarming and best managed if they have been anticipated and if mechanisms are in place (and regularly reviewed) for dealing with them. Adherence to basic principles is key for effective management.

Specific medical emergencies, requiring measures in addition to the general considerations discussed here, are discussed in the second paper.

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