



## Technology for the Dental Practice

# Automated External Defibrillators (AEDs): Why Put One In A Dental Office?

By Paul C. Asted

### The Problem

The number 1 killer of Americans is heart disease. In the United States this killer accounts for about 1 death every 33 seconds or 2600 per day. A syndrome called sudden cardiac arrest affects many of these patients. Today we know that most of these patients have sudden cardiac arrest from an electrical disturbance in the heart called ventricular fibrillation. Once in ventricular fibrillation, pulse ceases, and the lack of blood to the organs begins a very fast process of cell death.

### History

In 1849, Carl Ludwig applied a mild electric current to a heart and found that this would induce ventricular fibrillation. Fifty years later Prevost and Batelli found that after you put a heart into ventricular fibrillation with mild shock a more severe shock would convert it back to a "good" rhythm. This information was essentially ignored until Wiggers began researching how the process of fibrillation occurred. He was credited with a description of the breakdown of events in fibrillation and he also perfected defibrillation procedures in an animal model of defibrillation. Wigger's research was performed in the physiology department of Western Reserve University in Cleveland Ohio. Next Door in the University Hospital, Dr. Claude Beck had been watching Wiggers Research. Beck was a thoracic surgeon



and he is credited with the first successful defibrillation on a human. In 1947 he used a shock applied internally to a 14 year old boy who was undergoing elective chest surgery and went pulseless. In 1956 Zoll et al performed the first successful human **external** defibrillation. The first prehospital defibrillation in an ambulance was performed by physicians from Belfast in 1966 and the first use by emergency medical technicians without a physician present was in Portland, Oregon, in 1969. Today Automated External Defibrillators determine the need for shock and the operator must only press a button to accomplish what these pathfinders worked so hard to achieve. The pioneers in this field would be astounded to learn that thousands of individuals in the world are wearing an implanted Automatic Internal Defibrillator.

Today the AED is a remarkably easy device to use. They vary in price and sophistication. The purchaser must beware however since low price is not always the best solution. One company, which prided itself on being the first to break into the \$1000 range, recently recalled all of its units and withdrew all support after several Food and Drug Administration recalls. The owners of these units got no rebate on their expenditure and undoubtedly are looking to purchase another more trustworthy unit.

As more lay public are trained to use AEDs, the designers must continue to make units which give the most help to the rescuer. One unit even walks the rescuer through the initial assessment steps and gives feedback if CPR is necessary. The ZOLL AED PLUS ([www.Zoll-AGD.com](http://www.Zoll-AGD.com)) is designed with a graphical interface which helps the rescuer with the initial steps of assessing consciousness, calling 911, opening the airway, giving initial breaths, checking circulation and finally applying a unique pad set to the chest. The unit then evaluates the cardiac rhythm and determines shock/no shock. Whenever the patient is not to be shocked, the unit then advises to do CPR if no circulation is found. Because of the unique pads ZOLL uses, the ZOLL AED PLUS then assists the rescuer with an adaptive metronome which beeps on each compression and then increases or decreases rate until 100 beats per minute is established (100 beats per minute is the standard for Adult and Child CPR). It also reads the depth of chest compressions and assists the rescuer in maintaining a proper depth of compression. This is unique in the field of AEDs.

### Medical Oversight

A medical oversight program (even for some medical centers) gives assurance that local, state and federal protocol and laws are adhered to. Oversight also insures adherence to quality assurance in maintenance of the equipment and training of the users. If a third party is keeping records of maintenance, monitoring changes in laws or rules and advising the agency with the defibrillator of these changes, there is far less of a chance of leaving that professional office open to liability through ignorance. It has been common for this author to arrive to teach CPR and AED classes only to find expired pads, batteries or

even in some cases, supposedly trained staff unaware of the location of the AED. The small annual price for such oversight is far outweighed by the liability protection afforded to your practice.

### A Scenario

Your patient is a 62 year old woman with a history of hypertension and congestive heart failure. Today you are extracting a molar. Suddenly your patient's eyes open wide; she gasps, stiffens and goes completely flaccid. You call her name with no response. She is unresponsive to a sternal rub. You check her breathing and pulse and find that both are absent. You have your assistant run to the phone and call 911 while you position the chair flat. You search the equipment drawer for a CPR mask and are about to give two breaths when your assistant and hygienist return to say 911 is called and an ambulance is on the way. Approximately 1 minute has now elapsed. ***If defibrillation was performed now, an estimated 90 percent of patients would recover normal sinus rhythm.*** You begin two rescue breaths and recheck the pulse. As you begin two person CPR with your assistant, the hygienist brings in a Bag Valve Mask Resuscitator (BVM) and you switch to this for ventilations. You hook up an extension tube to your wall oxygen and the BVM and are now ventilating with nearly 100% oxygen. Three minutes have elapsed. ***Estimated recovery rate if defibrillated is 70%.*** The ambulance comes from several miles away and makes excellent time to your location. On arrival they immediately initiate defibrillation. Elapsed time from collapse to the shock is 7 minutes. ***The estimated save rate has dropped to 20% if shock is delivered now. Should the elapsed time stretch to 10 minutes, save rates are negligible.***

### A Question

Are you at risk for liability in this case for not having a defibrillator on hand? The answer to this question is of course a topic of some interest to all professional offices today. The consensus among many experts today, is that increasingly, you and your practice are in jeopardy in this type of situation. Because of the litigious nature of our society a perception exists, in the mind of the public, that, the professional office should be prepared for such eventualities.

### Public Perception vs. Reality

The average American spends hours per week in front of a television. A surprising amount of time is spent by this author in re-educating the public about the reality of prehospital emergency care. After enough dramatic portrayals of Sudden Cardiac Arrest (SCA) on television, the average person is guilty of several interesting misconceptions. The first is that everyone suffering SCA is shocked by prehospital providers. In reality 50 – 60 percent of patients suffering cardiac arrest in the field are in a rhythm which can be shocked by an AED. The remainder have a variety of rhythms which may or may not be responsive to other paramedic equipment or drugs. The second misconception is that once the patient is shocked, they nearly always recover. The estimates are certainly far less than 100 percent. The single most important factor in prehospital success is the **time** from arrest to defibrillation. In fact, as described in the above scenario, once five minutes has elapsed we have left the 50 percent save rate behind. If ten minutes had elapsed in our office scenario, the save rate would be negligible.

The explanation of this time problem involves consideration of the means by which a heart beat occurs. Natural electrical stimulation of the heart muscle initially begins in the sinus node and proceeds throughout the heart in a progressive fashion, from the top to the bottom (normal sinus rhythm). This takes energy and when ventricular fibrillation occurs, pulse ceases and oxygen depletion of cells begins. As heart cells die, less and less available energy remains. Defibrillation depolarizes the entire heart, yielding at least temporary asystole. The cells then must recharge. The sinus node is the most electrically active area of the heart and should then fire first. If this happens, a normal sinus rhythm should begin. There must be enough viable cardiac cells with enough energy to allow this to occur.

The publicity surrounding real life “saves” fuels a second factor in the expectation of the public. After watching enough evening news events of spectacular “saves” by AEDs in schools and sports events etc., and reading enough news articles of successes, the average layman begins to expect defibrillators to be everywhere.

### Legal Pressure

The pressure for inclusion of AEDs in planning for public and private facilities increases as the public hears about successful saves. Today the United States Congress, state legislatures and local communities are implementing requirements for the use of AEDs in settings other than medical centers (where a patient would reasonably expect such equipment). All United States commercial passenger airlines are required to outfit their fleets with AEDs. Large federal buildings must have AEDs and Arizona has a law that requires any state building constructed or renovated at a cost of \$250,000 or more, to be equipped with AEDs.

Another area where AEDs are being implemented is the sports and exercise industry. Sports stadiums and health clubs are increasingly being expected to have AEDs.

### Professional Pressure

In dental offices where conscious and unconscious sedation occurs, mandatory inclusion of an AED (unless trained providers have manual units) is becoming standard. The general and specialized dentist who doesn't sedate patients may have a need based on the pressure from public expectation but also from another more professional source. Nearly all states have some form of requirement for CPR training for dental professionals. If they are doing their job, every CPR instructor in the United States is telling their classes that AEDs need to shock as quickly after sudden cardiac arrest as possible. It is going to be very difficult for a dentist to deny that he knew that defibrillators should be included in his office. The knowledge that a need occurs drives the implementation of an AED program in the dental practice.

A review of literature regarding AED related liability cases demonstrates some interesting examples of the preceding concepts applied in lawsuits. Airlines faced some of the first lawsuits claiming that they did not protect their passengers. The Busch Gardens theme park was sued by the family of a 13 year old who suffered sudden cardiac arrest. The jury awarded \$500,000 in damages, at least in part because the park did not have an AED. In Florida a

sports club was sued for failure to have an AED. The patient remains in a coma with little brain function. The case was settled for \$2.25 million.

### Summary

The history of treatment of sudden cardiac arrest in the United States has led inexorably to a point today where we know that many of these patients may be saved by timely intervention.

The pressure of law, public expectation and concern for good patient care, has moved dentists to a point where they must eventually include an AED in their inventory of emergency equipment. In the meantime, a practice which doesn't have immediate access to a defibrillator is at risk for a lawsuit should a patient or staff member collapse from sudden cardiac arrest.

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