DANGER FROM THE DENTAL DRILL*

PETER A CHARLEBOIS, B SC , B A , M D

AT THE Scarborough General Hospital the Department of Anaesthesia has recently become affiliated with a very active Dental Department which utilizes the most recent advances in dental technology. Amongst the more recent advances are high-speed dental drills, which are engines powered by a compressed gas, usually air.

In general these units are designed with three basic components. The first is an air compressor which maintains compressed air in a tank at a pressure of between 30 and 60 pounds per square inch. The second part is usually a foot control by which the operator is able to vary the amount of gas which he allows to escape from the constant-pressure tank into the third component, a drill handpiece. By varying the amount of gas which he allows to enter the handpiece, the dentist can vary the speed of the drill he is using. Thus, although the driving gases are obtained from a constant-pressure source, the pressures and volumes used and exhausted are variable but increase as the speed of the drill increases. Each manufacturer has selected an optimum operating pressure for his unit. This pressure is usually within a range of 30 to 60 pounds per square inch. The pressure of the exhausting gases, which is of particular interest, is difficult to measure but is considered to be around 10 to 15 pounds per square inch.

These drills have two different systems for exhausting the driving gases. In one type of drill the driving gas is exhausted out the back of the handpiece away from the patient. However, with these handpieces the manufacturer may include a method whereby the dentist may redirect the gas or water into the operating field in order to remove debris. In the other type of handpiece the driving gas is exhausted continually through small ports around the dental drill and is always directed into the operating field. With this type of handpiece there are continuous fine jets of gas under pressure directed into the operative area. This dries the operative area, blowing away enamel bone chips and blood clot.

Thus with one type of handpiece the dentist can intermittently direct a fine jet of gas under pressure into the operative area. With the other type of handpiece it is an integral part of the design of the instrument that continuous jets of gas under pressure are directed into the operative area.

There seems little doubt that these jets of gas under a pressure of 10 to 15 pounds per square inch have caused surgical emphysema. An interesting report is found in the *Journal of the American Dental Association* of December 1961.⁴ This report states "during a dental examination air from a dental syringe at twelve to thirteen pounds per square inch was blown into a periodontal pocket for better visualization. Instantaneous cervico-fascial emphysema ensued. The

*From the Department of Anaesthesia, Scarborough General Hospital, Scarborough, Ontario, and the Scarborough Medical Research Foundation.

affected tissues were soft fluctuant and were not discoloured. The patient felt no pain but a stretching sensation of the face and neck" In a personal communication R S Locke¹ states that he has seen six cases of surgical emphysema, one of which had periorbital emphysema. He has seen this only in children, involving both the internal and external areas of the cheek. Dr. Locke believes that emphysema occurs only when the tissues have been dried by atropine and the air rotor.

The process by which surgical emphysema develops is probably mechanical in nature. The thin jets of gas are able to exert enough pressure to make dissections along the fascial planes, making pathways through the loose areolar tissue which offer very little resistance. The gas continues to flow from an area of high pressure to an area of lower pressure. Most gas will escape into the surrounding atmosphere but some will be forced into the fascial planes. The gas trapped in the fascial planes will continue to flow into areas of decreased pressure from areas of increased pressure, whether this increased pressure is caused by more compressed gases or tightening muscles. It is this gas trapped in the loose tissue of the body which gives physical evidence of surgical emphysema. The development of surgical emphysema entails varying degrees of danger depending upon the volume and position of the trapped gases. As a general rule we may say that the larger the volume of trapped gases, the greater will be the danger to the life of the patient. However, there is a very definite exception to this rule. As yet there have been only three reports of gas becoming trapped in the subcutaneous tissues of the pharynx or larynx, but only 5 or 10 c.c. of gas trapped in the loose tissue of the larynx, arytenoids, or epiglottis is sufficient to cause a serious mechanical obstruction of the upper airway.

The three reported cases of pharyngeal emphysema occurred before drills driven by compressed gas were available and did not lead to serious airway obstruction. Berg in 1928 described a case of post-extraction emphysema for which swallowing was difficult. Binns in 1935 described a patient whose swelling was painless but caused difficulty in swallowing and breathing as it extended on both sides of the trachea. Penny in 1949 described a bilateral swelling of the neck following extraction, and the patient felt that he was choking. From these case reports we see that pharyngeal emphysema does occur and that it can be a threat to the patient's life. Surgical emphysema after a dental procedure was first reported in the literature in 1870 when it was seen in a man who blew a bugle after a tooth extraction. Since then it has been reported after sneezing, clarinet playing, expectorating, nose blowing, blowing up a paper bag, and now after the use of a dental drill driven by compressed gas.

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