Irrigation System Equipped on a High-speed Air Drill
—Technical Note—

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Abstract
An irrigation system which can easily be applied to the conventional high-speed air drill was developed to allow simultaneous irrigation during micro-drilling. The irrigation system is constructed with a tube of 0.8 mm outer diameter and supporting rings. Irrigation is entirely coordinated with drilling by a single foot switch. The tube of the system ejects normal saline intermittently toward the cutter bar tip. Use of this system in skull base surgery showed that effective irrigation and a clean operative field was achieved even in a narrow space under the operating microscope, saline is ejected exactly on the point of drilling and over-heating does not occur so that heat-related damage to the local nerves and blood vessels is avoided. The system can easily be applied to any type of high-speed air drill by using supporting rings of the correct size. This irrigation system is particularly useful in microneurosurgery using the high-speed air drill.

Key words: high-speed air drill, irrigation system, microneurosurgery

Introduction
Use of the high-speed drill has become very common in microneurosurgery. However, an assistant has to perform irrigation using a syringe or resorber, causing crowding of the limited surgical space due to this second instrument or inexperience of the assistant. Inadequate timing of irrigation may also distract the surgeon. We have developed a simple instrument for irrigation which can be equipped on the high-speed air drill and allows surgeons to irrigate the site simultaneously without depending on an assistant. This instrument is quite useful for microneurosurgery, particularly skull base surgery.

Irrigation System
The irrigation system was manufactured by Watson & Marlow Inc. (Cornwall, Falmouth, England). The main body is very compact (22 × 30 × 10 cm) so is not cumbersome even in the operating room. The speed of the rotor can be changed manually within the range from 0.5 to 55 revolutions per minute, so the interval between irrigations can be changed. The switch to control irrigation is set beneath the foot pedal of the high-speed air drill. When the switch of the instrument is in the off position, the rotor does not turn, due to inertia. Since rotation stops promptly when the instrument is switched off, normal saline is not ejected after the drill stops. The irrigation system was designed to allow attachment to the hand piece of the high-speed air drill (Black Max®; ANSPACH, West Palm Beach, Fla., U.S.A.) and to allow the system to be removed with a single procedure. The irrigation head is constructed with a tube of 0.8 mm outer diameter and 0.5 mm inner diameter and supporting rings (Fig. 1). The tip is located near the cutter bar of the drill, and oriented so that the appropriate amount of normal saline is ejected toward the cutter bar tip. Since the tube is closely positioned along the main part of the drill, it does not obstruct the operative or visual field. This system can be easily applied to any type of drill by changing the supporting rings.
Discussion

Evaluation of the system during microneurosurgery showed that it did not obstruct the visual field even in the narrow space under the surgical microscope; irrigation exactly occurred on the tip of the blade of the bar, allowing elimination of bone dust as well as a smooth ostectomy; and adequate irrigation prevented accumulation of metallic powder which might cause artifacts during magnetic resonance imaging.\textsuperscript{3} The system can also free the surgeon to use both hands for microdrilling.

Local heating of the drilling site is unlikely to occur during ostectomy of the anterior clinoid process, because normal saline is constantly ejected by the irrigation device during drilling.\textsuperscript{4} Important nerves, such as the oculomotor and optic nerves, run in the vicinity of this site. The temperature of surface of the ostectomy site was well controlled by irrigation.\textsuperscript{5} Drilling can cause temperature elevation of the bone to 70°C around the drill tips.\textsuperscript{3} However, heat damage to these structures was avoided by cooling. The diamond bar is occasionally coated with black carbon when irrigation is delayed, leading to reduced drilling efficiency. When this system was used, bone dust was less likely to adhere to the tip of the cutter. Even if the diamond bar was used, the ability to cut during ostectomy was excellent.

Although another type of high-speed drill is available with irrigation, the present system can be easily equipped on any type of high-speed drill retrospectively. This system has no major problems. Especially, the high-speed air drill with coordinated irrigation system is considered to be useful in microneurosurgery.

References


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