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Content Strategist: Mary Hegeler
Content Development Manager: Rebecca Gruliow
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Book Designer: Ryan Cook

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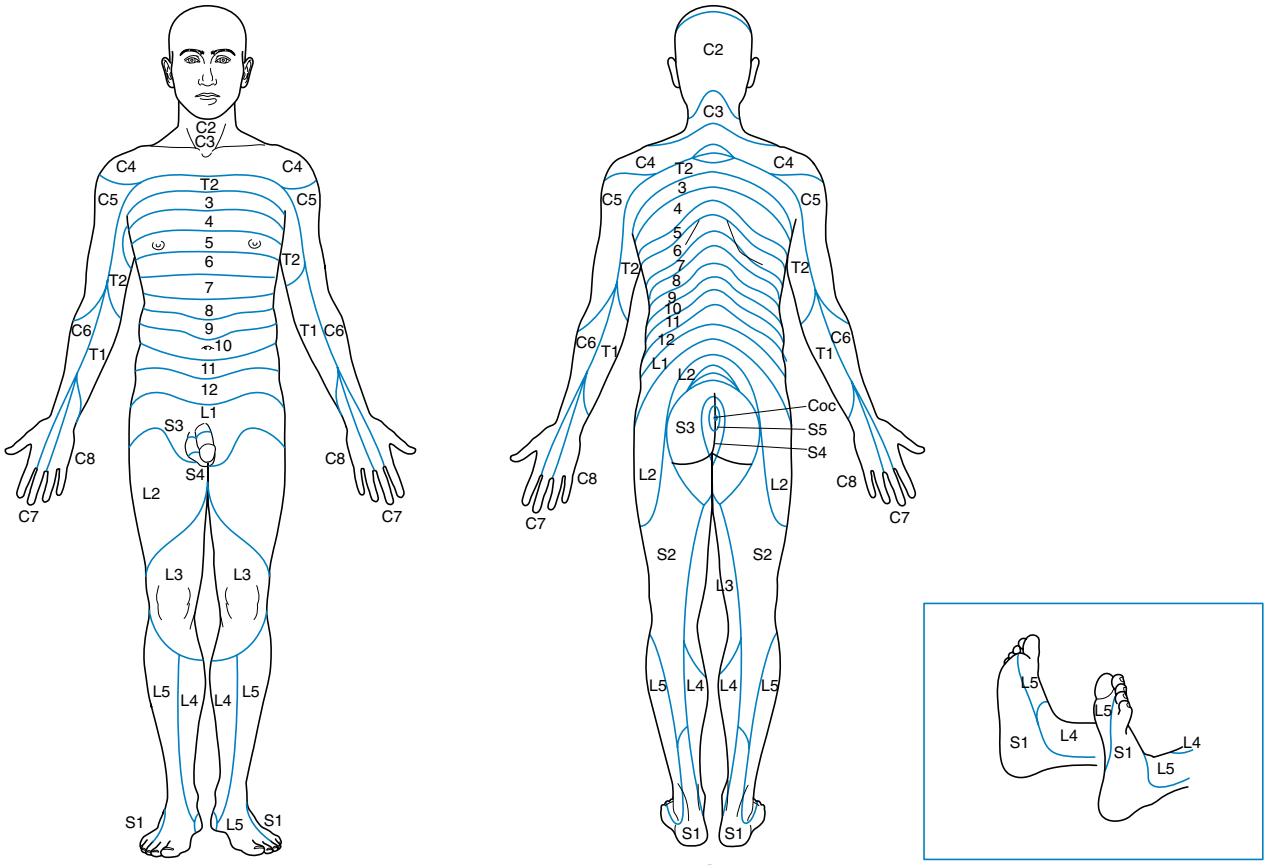


• **Fig. 1.2, cont'd**

loss of balance. If loss of balance is present when the eyes are open and closed, the examination is consistent with cerebellar ataxia. If the loss of balance occurs only when the eyes are closed, this is classically known as a positive Romberg sign indicating a proprioceptive (sensory) deficit.[46]

Apraxia

Apraxia is the loss of the ability to carry out programmed or planned movements despite adequate understanding of the tasks. This deficit is present even though the patient has no weakness or sensory loss. For a complex act to be accomplished, there must first be an idea or a formulation of a plan. The formulation of the plan must then be transferred into the motor system where it is executed. The examiner should watch the patient for motor-planning problems during the physical examination. For example, a patient might be unable to perform transfers and other mobility tasks but has adequate strength on formal manual muscle testing.[70] Ideomotor apraxia associated with a lesion of the dominant parietal lobe occurs when a patient cannot carry out motor commands but can perform the required movements under different circumstances. These patients can usually perform many complex acts automatically but cannot carry out the same acts on command. Ideational apraxia refers to the inability to carry out sequences of acts, although each component can be performed separately. Other forms of apraxia are constructional, dressing, oculomotor, oromotor, verbal, and gait apraxia. Dressing and constructional apraxia are often related to impairments of the nondominant parietal lobe, which typically are the result of neglect rather than actual deficit in motor planning.[46]

Involuntary Movements

Documenting involuntary movements is important in the overall neurologic examination. A careful survey of the patient usually shows the presence or absence of voluntary motor control. Tremor is the most common type of involuntary movement and is a rhythmic movement of a body part. Myoclonus, a quick jerking movement of a muscle or body part, can be seen with a variety of cerebral and spinal cord lesions and as a side effect of medication. Lesions in the basal ganglia produce characteristic movement disorders such as chorea, athetosis, dystonia, and hemiballismus. Chorea describes movements that consist of brief, random, nonrepetitive movements in a fidgety patient unable to sit still. Athetosis consists of twisting and writhing movements and is commonly seen in cerebral palsy. Dystonia is a sustained posturing that can affect small or large muscle groups. An example is torticollis, in which dystonic neck muscles pull the head to one side. Hemiballismus occurs when there are repetitive violent flailing movements that are usually caused by deficits in the subthalamic nucleus.[51]

Tone

Tone is the resistance of muscle to stretch or passive elongation (see Chapter 24), and spasticity is a velocity-dependent increase in the stretch reflex, whereas rigidity is the resistance of the limb to passive movement in the relaxed state (non–velocity dependent). Variability in tone is common because patients with spasticity can vary in their presentation throughout the day and with positional changes or mood. Some patients will demonstrate little tone at rest (static tone) but experience a surge of tone when they attempt to move the muscle during a functional activity (dynamic

• **Fig. 4.10** Different styles of hearing aids. (A) Completely-in-the-canal style. (B) Receiver-in-canal style. (C) Thin open style. (D) Receiver-in-canal behind-the-ear style. (Courtesy Widex USA Inc., Long Island City, NY.)

Bone-Anchored Hearing Aids

A bone-anchored hearing aid (BAHA) is a surgically implanted device that delivers sound via bone vibration to the cochlea. Individuals with conductive or mixed hearing loss, single-sided deafness, and an inability to tolerate conventional hearing aids in the ear canal are good candidates for the BAHA. In such a case, the patient has a small metal post—to which a sound processer is attached—implanted in the mastoid bone. The processor converts incoming sound to vibrations that are conducted to the inner ear via the skull, bypassing the outer and middle ear.

Middle Ear Implantable Hearing Aids

Middle ear implantable hearing aids are designed to treat conductive hearing loss and SNHL. The implanted portion of the device is attached to the ossicular chain and converts acoustic energy to mechanical vibratory energy. There are two types of middle ear implants: piezoelectric and electromagnetic. Candidates are patients who do not benefit from or cannot use conventional hearing aids (e.g., allergies/sensitivity to ear mold materials, chronic external ear infection) but have hearing loss that is not severe enough to qualify for a CI.

CASE 4.1

Auditory Impairment

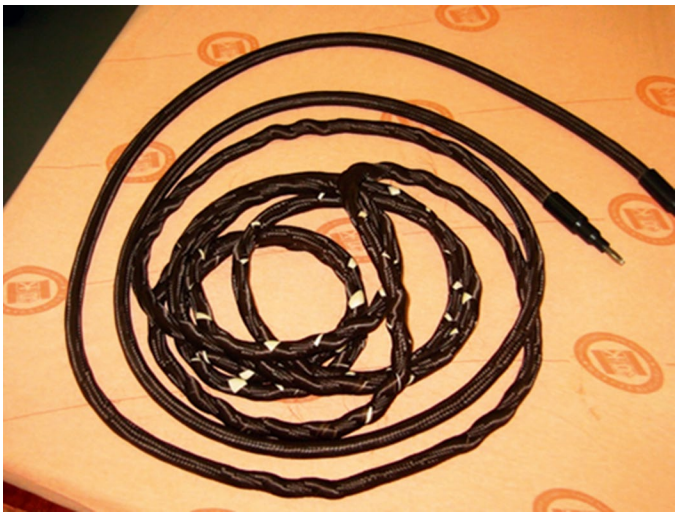
A 75-year-old male, a recently retired Vietnam-era war veteran, presented to the audiology service with two chief complaints: (1) considerable difficulty hearing people speak, especially females in noisy settings, and (2) constant perception of a high-pitched ringing-type sound that interferes with his daily activities, including sleep. A detailed history revealed service-related exposure to high levels of sound in the 1960s and long-term recreational noise exposure (e.g., hunting with a rifle, attendance at stock-car auto races, motorcycle riding). The history was negative for head trauma and ear disease. The patient reported a progressive worsening of his ability to communicate, which had contributed to his early retirement (he had been unable to perform his duties as an automobile salesman). The patient's spouse confirmed on the day of the assessment that his hearing problems and annoyance with the ringing sounds were putting increasing stress on their marriage.

Otoscopy showed a moderate amount of cerumen in each external ear canal, but the tympanic membranes appeared normal. Inspection of the external ear (pinna) showed several raised skin discolorations. Tympanometry confirmed normal middle ear function. Acoustic reflexes were not measured because of the patient's complaint of bothersome tinnitus and reduced

• **Fig. 18.13** Capacitor electrodes of shortwave diathermy produce a strong electrical field in between the two condenser plates.

and heat generation in areas with higher resistance to the passage of the electrical field, such as subcutaneous fat.[138]

Inductive electrodes consist of induction coils that produce, unlike capacitor electrodes, a stronger magnetic field (Fig. 18.14). The alternating magnetic field also moves ions and charged molecules and results in heat generation. The inductor electrodes produce more power absorption and higher heat generation in the deeper high-water-content tissue, such as muscle, than in subcutaneous fat. Commercially, there are different shapes of inductive electrodes available for different clinical settings. For example, pad electrodes are separately placed on the two sides of the back pain area to induce deep heat in the back muscles. Cable applicators consist of rubber-coated cables that are usually wrapped around an extremity, such as the knee joint, for the treatment of knee arthritis. Careful placement of the inductive coil to avoid crossover is important to avoid overheating. A drum-shaped applicator with coils encased in rigid housing can be positioned toward the target area. A 20- to 30-minute total treatment time for one body area is usually necessary to achieve enough heating and maximum therapeutic effects in the deep tissues.



• **Fig. 18.14** Inductor cable electrodes are usually wrapped around the treatment area (e.g., knee joint). They produce a strong magnetic field at the center of the coiled cable and generate heat.

Recently, pulsed SWD has also been used in the treatment of various soft tissue injuries and joint arthritis.[75] Pulsed SWD is produced by interrupting the output of conventional continuous SWD at consistent intervals. As a result of the heat dissipation during the off time, pulsed SWD is believed to function on cellular levels by its nonthermal effects. Pulsed SWD was found to induce dose-dependent increased rates of fibroblast and chondrocyte proliferation in vitro.[96] Pulsed SWD has also been theorized to induce membrane repolarization of damaged cells, thus correcting cell dysfunction. However, a recent meta-analysis found small, significant effects of pulsed SWD on pain and muscle performance only when the power levels of SWD were high enough to induce a local thermal sensation, suggesting the role of thermal effect.[132]

Indications and Evidence Basis

Continuous SWD is the technique of choice when uniform elevation of temperature is required in deep tissues and inside joints. As a result of the strong attenuation of ultrasound on bony structures, SWD is preferable if the target area is the interior of large joints, such as the knee, hip, or ankle. Subacute or chronic conditions respond well to continuous SWD, whereas acute lesions are better treated with pulsed SWD.[83] Heat reinforces acute inflammation, promoting further edema with exacerbation of pain; thus pulsed SWD is used more appropriately in the acute situation. Continuous SWD, when applied properly, is believed to have the ability to relieve pain and muscle spasm, resolve inflammation, reduce swelling, promote vasodilation, and increase soft tissue extensibility and joint ROM.

SWD, similar to other heating modalities, may elevate pain threshold and retard nerve transmission of pain signals, resulting in the reduction of chronic pain. Muscle spasm secondary to pain from musculoskeletal disorders could be effectively reduced by deep heat provided by SWD, and this in turn will contribute to the lessening of pain. Heat can also increase the elasticity of connective tissue and joint capsule if effectively delivered to the target areas, and SWD is thus ideal for the treatment of joint contracture.

Controversy exists for the effects of SWD on the treatment of osteoarthritis. Two recent control studies showed that both continuous and pulsed SWD treatments are effective short term for pain relief and improvement of function and quality of life in females with knee osteoarthritis.[16,75] However, other studies compared the additional effect of SWD on exercise training and found no further benefit.[7,190]

Contraindications and Precautions

In general, the common contraindications and precautions of SWD are similar to those for other methods of heating. For example, heating in areas with impaired sensation or patients with cognitive disability may result in burn injury. Owing to good bone penetration, heating of the epiphyseal plates in the long bones of children may affect growth; hence injudicious application of SWD to a child may lead to late side effects. SWD is contraindicated in areas with metal implants. Excessive heating and burn may be generated. SWD has also been found to have a definite adverse effect on some cardiac pacemakers. The adverse effects on pacemakers include an increase or decrease in pacemaker rate or rhythm, ventricular fibrillation, a total loss of pacing, or cessation of impulses.[112]

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