7.2: Sensory Impairments Basic Concepts

Interpreting Sensations

Before learning about sensory function, it is important to understand how the nervous system works. An intact nervous system is necessary for information to be delivered from the environment to the brain to trigger responses from the body. For neurons to transmit these messages, they are in the form of an action potential. Sensory receptors perceive a stimulus and then change the sensation to an electrical signal so that it can be transmitted to the brain and then out to the body. For example, a pain receptor perceives pain as your hand touches a hot tray. The signal is transmitted to the brain where it is interpreted, and then signals are quickly sent to the hand to pull away from the hot stimuli.[1]

Our bodies interpret sensations through a process using reception, perception, and reaction. Reception is the first part of the sensory process when a nerve cell or sensory receptor is stimulated by a sensation. Sensory receptors are activated by mechanical, chemical, or temperature stimuli. In addition to our five senses, we also have somatosensation. Somatosensation refers to sensory receptors that respond to stimuli such as pain, pressure, temperature, and vibration. It also includes vestibular sensation, a sense of spatial orientation and balance, and proprioception, the sense of the position of our bones, joints, and muscles. Although these sensory systems are all very different, they share a common purpose. They change a stimulus into an electrical signal that is transmitted in the nervous system.[2]

The sensory receptors for each of our senses work differently from one another. Light receptors, sound receptors, and touch receptors are each activated by different stimuli with specialized receptor specificity. For example, touch receptors are sensitive to pressure but do not have sensitivity to sound or light. Nerve impulses from sensory receptors travel along pathways to the spinal cord or directly to the brain. Some stimuli are also combined in the brain, such as our sense of smell that can affect our sense of taste.[3]
As an individual becomes aware of a stimulus and it is transmitted to the brain, perception occurs. **Perception** is the interpretation of a sensation. All sensory signals, except olfactory system input, are transmitted to the thalamus and to the appropriate region of the cortex of the brain. The thalamus, which is in the forebrain, acts as a relay station for sensory and motor signals. When a sensory signal leaves the thalamus, it is sent to the specific area of the cortex that processes that sense.[4] However, conditions that affect a person’s consciousness also affect the ability to perceive and interpret stimuli.

**Reaction** is the response that individuals have to a perception of a received stimulus. The brain determines what sensations are significant because it is impossible to react to all stimuli that are constantly received from our environment. A healthy brain maintains a balance between sensory stimuli received and those reaching awareness. However, sensory overload can occur if the amount of stimuli the brain is receiving is overwhelming to an individual. Sensory deprivation can also occur if there are insufficient sensations from the environment.[5]

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**Sensory Impairment**

Alterations in sensory function include sensory impairment, sensory overload, and sensory deprivation. **Sensory impairment** includes any type of difficulty that an individual has with one of their five senses. When an individual experiences loss of a sensory function, such as vision, the way they interact with the environment is affected. For example, when an individual gradually loses their vision, their reliance on other senses to receive information from the environment is often enhanced.

Safety is always a nursing consideration for a patient with a sensory impairment. Intact senses are required to make decisions about functioning safely within the environment. For example, an individual who has impaired hearing may not be able to hear a smoke alarm and requires visual indicators when the alarm is triggered.

Sensory impairments are very common in older adults. Most older adults develop impaired near vision called presbyopia. See Figure 7.2 for an image of simulated presbyopia.

Deficits in taste and smell are also prevalent in this age group. Additionally, **kinesthetic impairment** (an altered sense of touch) can occur in adults as young as 55. Kinesthetic impairment can cause difficulty in daily functioning, such as buttoning one’s shirt or performing other fine motor tasks. These sensory losses can greatly impact how older adults live and function.[7]
Vision Impairments

Several types of visual impairments commonly occur in older adults, including macular degeneration, cataracts, glaucoma, diabetic retinopathy, and presbyopia. See Table 7.2 for more information about each of these visual conditions.

Table 7.2 Common Visual Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
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<tbody>
<tr>
<td>Macular Degeneration</td>
<td><strong>Macular degeneration</strong> is the leading cause of legal blindness in individuals over 60 years of age. Risk factors include advancing age, a positive family history, hypertension, and smoking. In macular degeneration, there is loss of central vision with classic symptoms such as blurred central vision, distorted vision that causes difficulty driving and reading, and the requirement for brighter lights and magnification for close-up visual activities.</td>
</tr>
<tr>
<td>Cataracts</td>
<td><strong>Cataracts</strong> are the opacity of the lens of the eye that causes clouded, blurred, or dimmed vision. About half of individuals ages 65 to 75 will develop cataracts, with further incidence occurring after age 75. Cataracts can be removed with surgery that replaces the lens with an artificial lens.</td>
</tr>
<tr>
<td>Glaucoma</td>
<td><strong>Glaucoma</strong> is caused by elevated intraocular pressure that leads to progressive damage to the optic nerve, resulting in gradual loss of peripheral vision. It affects about 4% of individuals over age 70.</td>
</tr>
<tr>
<td>Diabetic Retinopathy</td>
<td><strong>Diabetic retinopathy</strong> is the leading cause of blindness in adults diagnosed with type 1 and type 2 diabetes mellitus. Diabetic retinopathy is a complication of diabetes mellitus due to damaged blood vessels in the retina causing vision loss.</td>
</tr>
<tr>
<td>Presbyopia</td>
<td>As a person ages, the lens of the eye gradually becomes thicker and loses flexibility. It stops focusing light on the retina correctly, causing impaired near vision and accommodation at all distances. <strong>Presbyopia</strong> starts in the early to mid-forties and worsens with aging. It can lead to significant visual impairment but does not usually cause blindness.</td>
</tr>
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Note

See simulated images of these visual conditions in the “Eye and Ear Basic Concepts” section of the “Eye and Ear Assessment” chapter of the Open RN Nursing Skills book.

Hearing Loss and Ear Problems

Approximately one third of individuals aged 70 and older have hearing loss. Good hearing depends on a series of events that change sound waves in the air into electrical signals. The auditory nerve conducts these electrical signals from the ear to the brain through a series of steps. The structures of the ear, such as the tympanic membrane and cochlea, must be intact and functioning appropriately for conduction of sound to occur. Age-related hearing loss (**presbycusis**) gradually occurs in most individuals as they age. Typically, low-pitched sounds are easiest to hear, but it often
becomes increasingly difficult to hear normal conversation, especially over loud background noise. Hearing aids are commonly used to enhance hearing. See Figure 7.3 for an image of common hearing aids used to treat hearing loss.

Figure 7.3 Common Hearing Aids

Hearing loss can be caused by other factors in addition to aging. A build-up of ear wax in the ear canal can cause temporary hearing loss. Sounds that are too loud or long-term exposure to loud noises can cause noise-induced hearing loss. For example, a loud explosion or employment using loud machinery without ear protection can damage the sensory hair cells in the ear. After these hair cells are damaged, the ability to hear is permanently diminished. Tinnitus, a medical term for ringing in the ears, can also occur. Some medications, such as high doses of aspirin or loop diuretics, can cause toxic effects to the sensory cells in the ear and lead to hearing loss or tinnitus. In addition to hearing loss, ear problems can also cause problems with balance, dizziness, and vertigo due to vestibular dysfunction.

Kinesthetic Impairments

Kinesthetic impairments, such as peripheral neuropathy, affect the ability to feel sensations. Symptoms of peripheral neuropathy include sensations of pain, burning, tingling, and numbness in the extremities that decrease a person’s ability to feel touch, pressure, and vibration. Position sense can also be affected and makes it difficult to coordinate complex movements, such as walking, fastening buttons, or maintaining balance when one’s eyes are closed. Peripheral neuropathy is caused by nerve damage that commonly occurs in patients with diabetes mellitus or peripheral vascular disease. It can also be caused by physical injuries, infections, autoimmune diseases, vitamin deficiencies, kidney diseases, liver diseases, and some medications.

Life Span Considerations

Impaired sensory functioning increases the risk for social isolation in older adults. For example, when individuals are not able to hear well, they may pretend to hear in an attempt to avoid embarrassment when asking for the information to be repeated. They may begin to avoid noisy environments or stop participating socially in conversations around them.

Infants and children are also at risk for vision and hearing impairments related to genetic or prenatal conditions. Early determination of sensory impairments is crucial so that problems can be addressed with accommodations to minimize the impact on a child’s development. For example, a screening hearing test is completed on all newborns before discharge to evaluate for hearing impairments that can affect their speech development.

Sensory Overload and Sensory Deprivation

Stimuli are continually received from a variety of sources in our environment and from within our bodies. When an individual receives too many stimuli or cannot selectively filter out meaningful stimuli, sensory overload can occur.
Symptoms of sensory overload include irritability, restlessness, covering ears or eyes to shield them from sensory input, and increased sensitivity to tactile input (i.e., scratchy fabric or sensations of medical equipment). Sensory overload affects an individual’s ability to interpret stimuli from their environment and can lead to confusion and agitation. See Figure 7.4 of an image of a patient reacting to sensory overload.

The health care environment with its frequent noisy alarms, treatments, staff interruptions, and noisy hallway conversations can cause sensory overload for patients. Individuals have different tolerances for the amount of stimuli that will affect them adversely. Tolerance to stimuli is impacted by factors such as pain, stress levels, sleep patterns, physical health, and emotional health. When sensory overload occurs in a hospitalized patient, it can lead to delirium and acute confusion. It is important for the nurse to limit unnecessary awakenings and interactions with the health care team members when a patient is experiencing sensory overload.

Conversely, symptoms of sensory deprivation may occur when there are a lack of stimuli. People experiencing sensory deprivation often report perceptual disturbances such as hallucinations. Symptoms of sensory deprivation can mimic delirium, so it is important for a nurse to further investigate new perceptual disturbances.

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