Healing properties have been attributed to light for thousands of years. Light provides electromagnetic radiation in the form of photons. A number of forms of light have been used for therapeutic purposes, including sunlight, incandescent light, infrared light, ultraviolet light, light-emitting diodes (LEDs), and, recently, therapeutic lasers. This chapter focuses on therapeutic lasers rather than surgical lasers. Laser therapy has been increasingly incorporated into rehabilitation programs for a variety of conditions, including skin wounds; muscle, tendon, and ligament injuries; neurologic conditions; arthritis; and pain. Many studies have indicated encouraging results with laser therapy. The principles of lasers, research pertaining to the use of laser therapies in rehabilitation, and the basics of laser therapy are addressed.

Laser Therapy

The term laser is an acronym for light amplification by stimulated emission of radiation. The concept of the use of light for therapeutic purposes, called phototherapy, originated from the belief that sun and other sources of light, such as infrared and ultraviolet light, have therapeutic benefit. Many different types of lasers are available for medical and industrial purposes. Low-power laser devices, a form of artificial light, were first used as a form of therapy more than 30 years ago. Today, a variety of lasers are in use for various purposes. The initial types of lasers used for rehabilitation purposes, commonly known as low-level laser therapy (LLLT), are also called cold lasers. In contrast, surgical lasers are high power and capable of thermal destruction of cells and tissues. Recently another form of laser, known as a therapeutic laser, has been introduced for rehabilitation purposes and delivers more power than low-level lasers, but less power than surgical lasers. Therapeutic lasers have become increasingly popular in both small and large animal rehabilitation for a variety of conditions.

The lasers used in rehabilitation help to modulate cellular functions. This process is known as photobiostimulation and is defined as nonthermal interaction of monochromatic radiation with a target site. Although the physiologic interaction of this type of energy application on tissue is still not completely understood, low-energy lasers have been reported to modulate various biologic processes, such as mitochondrial respiration and adenosine triphosphate (ATP) synthesis, to accelerate wound and joint healing, and to promote muscle regeneration. In addition, acute and chronic pain control has been reported using this type of low-energy photon therapy. Treatment of chronic and acute edema, neurologic conditions, and postoperative care are some other popular conditions treated with laser therapy.

Wound Healing

- Fibroblast stimulation
- Capillary formation and angiogenesis
- Collagen formation

• Enhanced adenosine triphosphate, protein, and growth factor production

• Vasodilation

• Lymphatic drainage

• Potential inhibition of wound healing at high doses

Bone and Cartilage

• Enhanced early bone repair

• Increased collagen deposition and bone trabeculae

• Adjunct to treatment of osteomyelitis

• Fibrous healing of cartilaginous defects

• Improved maintenance of cartilage in immobilized joints

Arthritis

• Inhibition of inflammation

• Inhibition of cyclooxygenase-2 enzyme and prostaglandins

• Reduced pain

• Possible reduction of morning stiffness in rheumatoid arthritis

Ligament and Tendon Conditions

• Pain reduction in acute tendonitis

• Improvement with lateral epicondylitis

• Reduced pain and inflammation in Achilles tendonitis

• Improved collagen organization

• Improved biomechanical properties

Analgesia

• Reduced pain in postoperative incisions

Inhibits Nociceptors

• Potential reduction in transmission of pain signals to pain centers in the brain

• Increased release of endorphins and enkephalins

• Stimulation of trigger points and acupuncture points

• Slowing of nerve conduction velocity

• Reduced action potential

• Suppressed substance P

• Disruption of axonal flow

Peripheral Nerves and Spinal Cord

• Promotion of nerve recovery after injury

• Increased axonal sprouting and growth

• Increased myelinization

• Reduced degeneration of neurons

• Increased growth-associated protein-43 and calcitonin gene–related peptide