2.5 Laser Safety

The low intensity laser irradiation or monochromatic light (LIL) are very safe: however, there is a potential for damage to the eye. The laser beam, if directed through the lens of the eye, could damage the retina. Yet in more than 40 years of research and clinical practice, an event of this type has never been reported. Protective goggles that filter out the specific wavelength of the laser light are suggested to be worn by the patient and acupuncturist/physician during a therapy session.

To safely operate a laser, the practitioner must thoroughly understand the nature of the equipment. Certain technical parameters exist that one must first comprehend. These parameters are the power (this is expressed in mW for LIL), wavelength, the characteristics of the laser beam (its optics: such as divergence, convergence, or parallel nature of the beam). All these influence the level of risk. Obviously, a high-power laser is riskier than a low-power one. An infrared laser is riskier to use than a visible, red light laser with the same power and beam characteristics because the light is invisible and does not promote a blink response.

The following factors are of importance regarding the eye risk of different lasers:

1 The divergence of the light beam. A parallel light beam with a small diameter is by far the most dangerous type of beam. It can enter the pupil, in its entirety, and be focused by the eye’s lens to a spot with a diameter of hundredths of a millimeter. The entire light output is concentrated on this small area. With a 10mW beam, the power density can be up to 12,000 W/cm². It is fairly obvious that a powerful laser (many watts) is more hazardous to stare into than a weak laser. The divergence is represented with divergence angle, 1 rad is 57°. There is less damage of light of large divergence angle on eyes.
2 The wavelength of the light. Within the visible wavelength range, we respond to strong light with a quick reflex. This reduces the exposure time and thereby the light energy which enters the eye. Light sources which emit invisible radiation, whether an infra-red laser or an infra-red light from light emitting diode array(LED), always entail a higher risk than the equivalent source of visible light. Radiation at wavelengths over 1400nm is absorbed by the eye’s lens, which might induce lens opacity. Radiation at wavelengths over 3,000nm is absorbed by the cornea, which might induce cornea injury.

3 The distribution of the light source. If the light source concentrated, which is often the case in the context of lasers, an image of the source is projected on the retina as a point, provided it lies with our accommodations range, i.e. the area in which we can see clearly. A widely spread light source is projected onto the retina in a correspondingly wide image, in which the light is spread over a larger area, i.e. with a lower power density as a consequence. For example: a clear light bulb (which is apprehended as a more concentrated light source) penetrates the eye more than a so-called “pearl” light bulb. A laser system with several light sources placed separately, such as a multiprobe (the probe is the part of the laser you hold and apply to the area to be treated: a single probe means there is only one laser diode in the probe, as opposed to a multiprobe, which has several laser diodes) with several laser diodes, can, seen as a whole, be very power but at the same time constitute a smaller hazard to the eye than if the entire power output was from once laser diode, because the diodes’ separate placement means that they are reproduced in different places on the retina.