UNIT V

PRINCIPLE & APPLICATIONS OF SOUND IN MEDICINE

5.1 PHYSICS OF SOUND

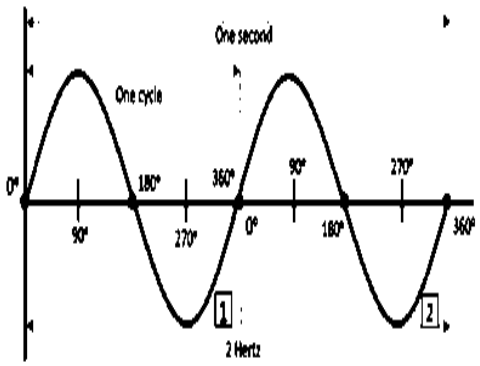
Sound is a mechanical wave that travels in a medium in longitudinal manner.

Seven acoustic parameters describe the characteristics of a sound wave.

1. Frequency
2. Period
3. Amplitude
4. Power
5. Intensity
6. Wavelength
7. Propagation speed)

1. Frequency

Frequency of a sound wave is the number of cycles that occurs in one second (Figure 5.1). The unit Hertz is 1 cycle/second) The unit Hertz is abbreviated as Hz. Frequency is an important characteristic of sound in ultrasound imaging as it affects penetration of sound and image quality.

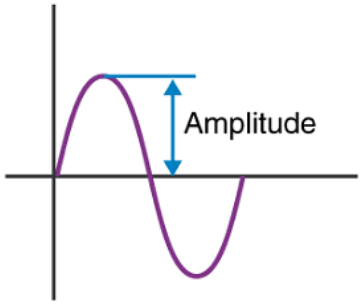


2. Period

Period of a sound wave is related to the time that a wave takes to vibrate up and down and thus is reciprocally related to frequency: For instance, a sound wave with a frequency of 10 Hertz will have a period of 1/10 second.

3. Amplitude

Amplitude is defined by the difference between the peak (maximum) or trough (minimum) of the wave and the average value



Units of amplitudes are expressed in pressure parameters (Pascals) and in clinica imaging in million Pascals (MPa). The amplitude of a sound wave diminishes as soun propagates through the body.

4. Power

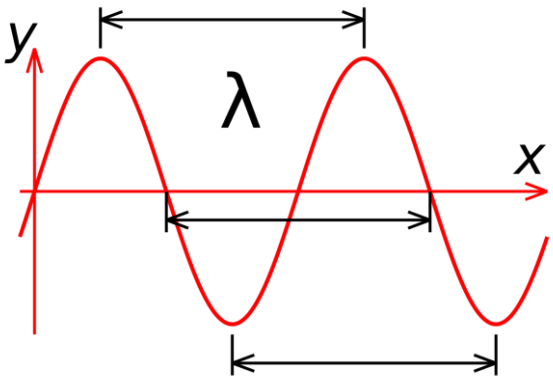
Power is the rate of energy transferred through the sound wave and is expressed Watts. Power is proportional to the amplitude squared of a sound wave. Power can altered up or down by a control on the ultrasound machine.

5. Intensity

Intensity is the concentration of energy in a sound wave and thus is dependent on power and the cross-sectional area of the sound beam. The intensity of a pound is thus calculated by dividing the power of a sound beam (Watts) s area (cm^2), expressed in units of W/cm

6. Wavelength

The wavelength of a sound wave is the length of a wave and is defined as the distance of a complete cycle. It is designated by the symbol lambda (2), is expressed in mm in clinical settings.



NORMAL SOUND LEVELS

If the intensity of the noise is too high and if exposure to excessive sound levels is prolonged, this pressure can damage bearing.

Sounds at or below 70 dB are generally considered safe.

Any sound at or above 85 dB is more likely to damage hearing over time Researchers have found that people who are exposed over long periods of time to noise levels at 85 dB or higher are at a much greater risk for hearing loss.

A sound at a level of 120dB will cause physical discomfort.

Nome levels above 140dB can cause damage to hearing after just one exposure Noise-induced hearing loss is permanent.