ULTRASOUND DIAGNOSIS OF ITS PROPERTIES

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Annotation: The imaging characteristics of diagnostic ultrasound (US) are determined by the ultrasonic properties of tissue. The velocity of propagation of US and the attenuation are the 2 most important parameters. These determine the frequency with which the tissues may be imaged, which in turn sets a fundamental limit on the axial and the lateral resolution. Ultrasonic imaging equipment is designed on the premise that the ultrasonic energy propagates through tissue in a straight line and that the ultrasonic beam is very narrow. In fact, the ultrasonic energy propagates through tissue as a beam of finite dimensions set by the physical dimensions of the transducer, the way it is constructed, and the way it is energized. Also, the velocity of propagation in different tissues varies and this can lead to deviation of the ultrasonic beam from the assumed direction of propagation

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Ultrasound examination (echography, scanning) is the only highly informative, safe non-invasive method that allows dynamic monitoring of the fetus from the earliest stages of its development.
This breakdown in assumptions leads to the creation of artifacts that must be appreciated in the interpretation of ultrasonic images. For this reason skilled interpreters of ultrasonic images follow 3 golden rules: never make an interpretation on a single image; just because a feature is displayed do not consider that it is necessarily real; and just because a feature is not displayed do not consider that it is necessarily not there. In the subjects assessed, the thickness of the palatal gingiva at the lateral-canine area was the highest followed by the premolar area. In periodontal root coverage procedures and during implant therapy, we suggest the inclusion of the lateral incisor area, apart from the canine and premolar area, as a potential donor site for harvesting soft tissue grafts from the palatal area. However, the effect of several factors like age and sex of the patient, the anatomy of the palatal area, the influence of rugae patterns and racial and geographical differences should be taken into consideration prior to harvesting a graft from these sites. Apart from this, the study suggests that, the ultrasonographic measurements provide an elegant means of obtaining the measurements of gingival and mucosal tissues rapidly, accurately and non-invasively. Our endeavour in this research project attempts to open more avenues for studies in the field of advanced periodontal diagnosis, with the use of ultrasound, and expand the horizons of periodontal plastic surgery and implant therapy as well. Ultrasound, like any wave, carries energy that can be absorbed by the medium carrying it, producing effects that vary with intensity. When focused to intensities of 103 to 105 W/m2, ultrasound can be used to shatter gallstones or pulverize cancerous tissue in surgical procedures. (See Figure 2.) Intensities this

great can damage individual cells, variously causing their protoplasm to stream inside them, altering their permeability, or rupturing their walls through cavitation. Cavitation is the creation of vapor cavities in a fluid—the longitudinal vibrations in ultrasound alternatively compress and expand the medium, and at sufficient amplitudes the expansion separates molecules. Most cavitation damage is done when the cavities collapse, producing even greater shock pressures.

Using this mode (elastometry), it is possible to determine the stage of liver fibrosis, which is especially important in patients with various hepatitis to determine the correct treatment tactics and now there is no need for a liver biopsy.

When used for imaging, ultrasonic waves are emitted from a transducer, a crystal exhibiting the piezoelectric effect (the expansion and contraction of a substance when a voltage is applied across it, causing a vibration of the crystal). These high-frequency vibrations are transmitted into any tissue in contact with the transducer. Similarly, if a pressure is applied to the crystal (in the form of a wave reflected off tissue layers), a voltage is produced which can be recorded. The crystal therefore acts as both a transmitter and a receiver of sound. Ultrasound is also partially absorbed by tissue on its path, both on its journey away from the transducer and on its return journey. From the time between when the original signal is sent and when the reflections from various boundaries between media are received, (as well as a measure of the intensity loss of the signal), the nature and position of each boundary between tissues and organs may be deduced.

Reflections at boundaries between two different media occur because of differences in a characteristic known as the acoustic impedance Z of each substance. Impedance is defined as $Z = \rho v$, where ρ is the density of the medium (in kg/m3) and v is the speed of sound through the medium (in m/s). The units for Z are therefore kg/(m2 · s).

Table 1 shows the density and speed of sound through various media (including various soft tissues) and the associated acoustic impedances. Note that the acoustic impedances for soft tissue do not vary much but that there is a big difference between the acoustic impedance of soft tissue and air and also between soft tissue and bone.

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