

UST - ultrasound therapy

It refers to mechanical vibrations of higher frequency ranging from 1 mega hertz to 3 mega hertz. (MHz).

Components of UST :-

Main supply :- This is the A.C normally of 220V having the frequency of 50Hz.

Transformer :- In this step up transformer is used to increase the voltage of current. The current now flow from transformer to rectifier.

Rectifier :- The current is converted from A.C to D.C.

Oscillator :- The purpose of oscillator is to produce high frequency oscillating current to the output circuit.

Amplifier :- The purpose process of increasing the magnitude of current is called amplification.

Coaxial cable :- It is a simple wire covered by a metallic plate which runs parallel to the wire and is separated by insulating material. It takes the current to the transducer head.

Production of therapeutic ultrasound :-

Piezoelectric transducer head is used to achieve high frequency ultrasound energy needed for imaging and therapy.

These are suitably cut crystals which deform under influence of electric charges. This is called piezoelectric effect.

Mostly quartz, barium titanate and lead zirconate titanate are used.

In order to apply the electric charges, the metal electrodes or linking electrode must be fixed to the crystal.

If a suitable metal plate is fixed to one surface of crystal while the opposing surface is in the air. Then all the vibrational energy i.e. the ultrasonic waves is transmitted from crystal to plate and from plate to any solid or liquid to which it is applied. This is the transducer head which is used to transmit the ultrasonic waves to the tissue.

Reflection of ultrasound :- If an ultrasound beam travelling through one medium which will not transmit it, reflection takes place.

Air will not transmit ultrasonic waves so, while using ultrasound care should be taken to avoid having air between treatment head and patient tissue to minimise reflection.

Transmission of ultrasonic waves :-

If the ultrasonic beam encounters an interface between two media and is transmitted it may be refracted i.e. deflected from its original path.

When travelling from a medium in which its velocity is low into one in which its velocity is high, it is refracted away from the normal.

Ultrasonic field :-

The ultrasonic beam is roughly cylindrical and of the same diameter as the transducer head.

The beam of ultrasound emitted from transducer is not uniform. This beam non uniformity ratio (BNR) is the ratio between peak intensity and the average intensity in the beam.

When the ultrasound waves emitted, some of the waves cancel out, some arrive out of phase and others reinforce so that net result is very irregular pattern of waves in the region close

to the transducer head : called Near field or Fresnel zone and in the region beyond this is Far field or Fraunhofer zone that is more regular.

The length of near field depends directly on the square of the radius of the transducer face and inversely on the wavelength. Thus, the length of near field = $\frac{r^2}{\lambda}$

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