3: Basic Instrument Design / Yale Fisher, MD

Transcript

We're going to talk about basic instrument design next but I thought I should mention something about the level of tissue destruction by ultrasound, or the lack thereof actually.

Because ultrasound is used in a variety of different areas in our daily lives, for example, jewelry cleaning. Any woman who has taken her jewelry to the jeweler to have it cleaned notices immediately that they drop their rings, or anything that needs to be cleaned, into a bath and then a small switch is thrown and the water begins to move fairly aggressively. And after a few moments, their jewelry is clean. And this is all done with ultrasound. But the ultrasound used in cleaners is quite high in its' power level - watts per square centimeter.

In diagnostic B-scan, we are using VERY LOW power levels, even lower than door openers or guidance for the blind. So you need not worry about causing tissue destruction when you're doing contact ultrasonography.

Now, basically, how are instruments designed?

They're designed pretty much the same way for all the different instruments. There is a probe with a transducer on the end, which sends out a wave front and waits for the returning echo. Usually, the transducer rings for about eighty nanoseconds and listens for about two to three hundred milliseconds. So, actually, that little probe is listening much more than it is sending out a wave front.

When the wave fronts return, the echoes return, the electricity - I'm sorry, the wave front- causes the transducer to move back and forth and then generates an electrical phenomenon, which then runs up the wire, from the transducer itself, into the ultrasound unit.

Once it gets inside the machine, the first thing it usually encounters is an amplifier. Once it goes through the amplifier, the weak signal becomes a rather large signal but again, still a sine wave.

The next thing that happens, usually, is that the signal will go through a rectifier, an electronic instrument to change the negative sine wave to all positive.

So, basically, the returning echo is both amplified and all in one direction from a single line. This permits display.