BONE CONDUCTION AND MECHANOTRANSDUCTION

When sound comes into contact with the human body, it is not perceived only by the ear. A substantial portion of vibrational energy is transmitted directly into bodily structures, giving rise to two fundamental processes bone conduction and mechanotransduction. In this way, vibrations can become biological information.

Bone conduction refers to the propagation of sound vibrations through bone, reaching deeper structures without relying exclusively on the auditory canal. This mechanism is well established in audiology, neurology, and prosthetic technology. In the human body, bones are excellent conductors of vibration: transmission is rapid and efficient, and energy attenuation is relatively low.

When vibration is applied to the body open- through a vibroacoustic table, a recliner, a transducer, or any vibrating surface—it can travel through the skeletal system and reach regions far from the point of application, producing a global, rather than a local stimulus. A vibration applied, for example, at the pelvis or along the spine may be perceived at the cranial or thoracic level.

BEYOND HEARING: VIBRATION AS PHYSICAL INFORMATION

Unlike airborne sound, vibration transmitted via bone conduction is not filtered by the middle ear. Therefore, it does not depend on auditory threshold and directly involves the body. Vibrotactile perception becomes somatic, proprioceptive, and interoceptive. In this sense, vibroacoustics does not stimulate hearing alone, but the broader perceptual system.

MECHANOTRANSDUCTION: WHEN MOVEMENT BECOMES A SIGNAL

Mechanotransduction is the biological process by which a mechanical stimulus is converted into a biochemical and/or electrical signal. It is a foundational principle in cell biology. Cells are not rigid structures; They are responsive to mechanical forces such as pressure, vibration, and oscillation.

When a vibrational wave passes through tissue, it can produce small deformations of cell membranes, activate mechanosensitive ion channels, modulate membrane receptors, and engage the cytoskeleton—thereby transmitting signals and information to cellular organelles.

This process does not require high intensity the quality, rhythm, and coherence of the stimulus are often more important than sheer force.

Through mechanotransduction, vibrations can alter intracellular signaling, influence autonomic nervous system tone, and participate in the regulation of arousal state. In particular:

- slow, regular vibrations tend to support parasympathetic states,
- irregular or high intensity patterns may increase activation.

This makes vibroacoustics a tool for modulation rather than imposition—a bridge between mechanics and electrophysiology. Although acoustic vibrations are mechanical waves, they can influence electrical signaling by interacting with ionic gradients and modulating neuronal dynamics. This is not a direct conversion into electromagnetic waves semicolon rather comma it is a chain of biological conversions in which mechanical motion stimulates tissue comma cells translate motion into signals comma and the system integrates the information.

Vibroacoustics fits within this chain as a facilitator of regulatory processes.

INTEGRATING THE LEVELS

We can conceptualize the path of sound in the body as a sequence:

* **space propagation** (air, liquids, solids)
* **bone conduction** (structural transmission)
* **mechanotransduction** (biological conversion)
* **functional regulation** (system response)

Each level does not replace the others; It complements them.

When someone enters into relationship with the body, it is not only something that is heard. It is something that passes through, moves, informs, and organizes. Bone conduction and mechanotransduction clarify how vibration can become a deep embodied experience—without forcing interpretations or invoking mysticism. Physiology itself provides the bridge between vibration and function.