Distortional and Compressional Bone Conduction

- Skull Vibrations
- Bekesy 1934 – Compressional Theory
- Tonndorf 1962 – Distortional Theory

The impedance mismatch between air conduction and bone conduction is about 50dB, so in order for bone conduction sounds to be heard, they must exceed the air conduction threshold by 50dB. AC and BC both initiate the same traveling wave in the cochlea. Bekesy showed that a frequency sound of less than 200 Hz stimulates the whole skull as a unit, around 800 Hz the skull vibrates in 2 segments (front and back) and over 1800 Hz the skull vibrates in 4 segments.

Bekesy compressional theory in 1934 also stated that the compliance of the oval and round window is responsible for bone conduction hearing. (1) When the round window compliance is equal to the oval window compliance, cochlear fluids are not compressible and there is equal bulging at oval and round windows, and (2) when the round window compliance is greater than the oval window compliance the basilar membrane is displaced downwards and since the area of the vestibule and scala vestibuli is greater than the area of scala media, the basilar membrane is even more displaced downwards, the pressure build up is released through the cochlear aqueduct.

In 1962, Tonndorf's distortional theory replaced the compressional theory by showing that even when the oval and round window were otosclerotic, there is still bone conduction. The distortional theory states that the mechanisms of bone conduction is the distortional vibration of the cochlea. Since the volume of the scala vestibule is greater than the volume of the scala tympani, distortions cause displacement of the basilar membrane.