

## Tinnitus Origin: A Brief Review of Theories

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Tinnitus is the feeling of sound in the ear(s) or head, without external physical origin [1]. The otologic and non-otologic factors may contribute to tinnitus; however, the cause of tinnitus is unknown in approximately 30% of cases [2,3]. The most common type of tinnitus is subjective tinnitus, in which the sound can be perceived merely by the patient [2]. The tinnitus prevalence of in different studies varies according to reasons such as the exact definition of tinnitus, data collection method, etc [4].

Early tinnitus theories were mainly based on peripheral models and hearing system involvement, especially cochlear lesion, and its rationale was that in cases such as noise induced tinnitus, the pattern of hearing loss is correlated with pitch of tinnitus [4]. Nevertheless, this theory may not explain the presence of tinnitus in normal hearing subjects, which accounts for 10% of tinnitus patients [5]. Studies have also shown that even with the cochlear nerve section, tinnitus may still persist; therefore, it seems that tinnitus origin may be beyond the peripheral auditory system [3].

Recent theories about the origin of tinnitus were based on that most of tinnitus are the result of complex interactions between peripheral and central mechanisms within the auditory system [6]. Accordingly, tinnitus can be considered as neuroplasticity change, in which initiation and persistence of tinnitus induced by peripheral and central auditory system, respectively [6]. It should be noted that merely involvement of the auditory system may not explain the symptoms of tinnitus, such as distress or annoyance. Recent MEG and fMRI studies have shown that abnormal activity in frontal cortex, especially DLPFC, and also limbic system involvement could be related to tinnitus symptoms [7,8].

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In summary, it can be concluded that in the case of tinnitus, we are dealing with networks consisting of pathways in the auditory cortex, frontal cortex and limbic system; and providing of treatment options appropriate to the mentioned areas involvement may yield better tinnitus management.

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