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“Effect of Sleep Deprivation on Noise-Induced Hearing Impairment in Young Adults Using Earphones: A Conceptual Review”.

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Abstract:

Noise-induced hearing impairment is an emerging public health issue among young adults, largely due to prolonged earphone use, unsafe listening practices, and modern lifestyle factors. Sleep deprivation (*Nidranāśa*), increasingly prevalent among youth, has been shown to exacerbate auditory damage by elevating stress hormones, disrupting melatonin balance, and intensifying oxidative stress. Ayurveda emphasizes *Nidrā* as one of the *Trayopastambha* (three pillars of health) and describes auditory disturbances (*Karnanāda*, *Badhirya*) as outcomes of *Vāta* vitiation associated with sleep loss. Panchakarma interventions such as *Nasya*, *Karna Pūrana*, *Śiro Abhyanga*, and *Śirodhara* are indicated in *Ūrdhwajatrugata Roga* (ENT disorders)

and may serve both preventive and supportive roles. This review integrates Ayurvedic concepts with modern research to highlight the compounded effects of sleep deprivation and noise exposure on auditory health and explores Panchakarma-based strategies for prevention and management.

Keywords: Noise-induced hearing loss, Sleep deprivation, Earphones, *Ayurveda*, *Nidranāśa*, *Panchakarma*, *Karnanāda*, *Badhirya*

Introduction

- Unsafe listening through personal audio devices is a leading cause of early hearing loss.

- WHO estimates >1 billion young adults are at risk due to unsafe earphone use.
- Simultaneously, sleep deprivation is a growing lifestyle problem linked to stress, gadget use, and irregular routines.
- Modern research confirms that sleep deprivation aggravates susceptibility to cochlear injury under noise exposure.
- Ayurveda identifies *Nidrā* as a fundamental pillar of health, and loss of sleep leads to *Vāta prakopa*, manifesting as auditory disorders.
- Panchakarma therapies are specifically mentioned in *Śālākya Tantra* for ENT care and can offer integrative preventive measures.

Noise-Induced Hearing Impairment

- Mechanism: High-intensity or prolonged noise → outer hair cell loss, oxidative stress, excitotoxicity, synaptic ribbon degeneration.
- Earphones: Deliver sound directly, raising risk of high-frequency hearing loss and tinnitus.
- Clinical Presentation: Temporary or permanent threshold shifts, *Karnanāda* (tinnitus), difficulty in speech discrimination.

Sleep Deprivation and Auditory Health

- Experimental Findings: Sleep-deprived mice show more severe hair cell loss after noise exposure [1].

- Epidemiological Data: Short sleep duration + noise exposure increases risk of hearing loss in adult populations [2].
- Pathophysiology: Elevated cortisol, suppressed melatonin, poor cochlear recovery, impaired synaptic repair.
- Ayurvedic Correlation: *Nidranāśa* produces *Vāta vitiation*, causing *Karnanāda* (tinnitus) and *Badhirya* (hearing loss) as noted in *Charaka Samhita* (Sūtrasthāna 21).

Ayurvedic Perspective (Classical View)

- *Nidra* is a *Trayopastambha* along with *Ahara* and *Brahmacharya* (Ch.Su. 11/35).
- *Nidranāśa* leads to *Vāta prakopa*, causing ENT manifestations.
- *Karna Roga* classification includes *Karnanāda*, *Badhirya*, *Karna Kṣveda* – comparable to tinnitus and hearing impairment.
- *Hetu* (causes): *Ati-śabda sevana* (excessive noise exposure), *Vātaprakopa*, *Nidra-viparyaya* (sleep irregularities).
- *Chikitsā*: Emphasis on *Nasya*, *Karna Purana*, *Rasayana* for prevention and management.

Panchakarma in Auditory Protection

1. Nasya (Nasal Instillation)

- *Anu Taila*, *Śadbindu Taila* strengthen *Indriya*, improve *Prana Vata* circulation, and prevent ENT disorders.

- Mentioned in *Dinacharya* as a daily preventive measure (Ch.Su. 5/58).

2. Karna Pūrana (Ear Oil Instillation)

- Medicated oil/ghee instilled in ears pacifies *Vāta*, prevents *Karnanāda*, *Badhirya*.
- Oils like *Bilva Taila*, *Nirgundi Taila* are recommended in *Karna Roga*.

3. Śiro Abhyanga (Head Massage)

- Daily practice promotes *Nidra*, relieves stress, nourishes sense organs.
- Classical texts describe it as *Netra-Karna-Roga Nāśana*.

4. Śirodhara (Oil Pouring Therapy)

- Reduces stress, induces *Nidra*, regulates *Manovaha Srotas*.
- Shown in modern studies to lower cortisol and improve sleep quality.

Preventive Lifestyle Integration

- Modern: Safe listening (60-60 rule), noise-cancelling devices, sleep hygiene, limiting screen exposure.
- Ayurveda: Daily *Dinacharya* practices (*Nasya*, *Śiro Abhyanga*, *Karna Purana*), *Rasayana* (Triphala, Brahmi, *Aśvagandha*), balanced sleep, avoidance of *Ati-śabda sevana*.

Discussion

- Prolonged earphone use + sleep deprivation creates compounded auditory risk.

- Ayurveda's conceptual framework (*Nidra* → *Vata* balance → *Karna Roga*) aligns with modern pathophysiology (stress hormones → cochlear injury).
- Panchakarma therapies serve both as preventive (*Dinacharya*) and supportive interventions.
- Integrative models combining audiology with Panchakarma warrant future clinical research.

Conclusion

- Young adults are increasingly prone to NIHL due to lifestyle choices.
- Sleep deprivation intensifies vulnerability, highlighting the importance of preventive strategies.
- Ayurveda provides a holistic framework: *Nidra palana*, *Panchakarma*, *Rasayana*.
- Panchakarma procedures (*Nasya*, *Karna Purana*, *Shiro Abhyanga*, *Shirodhara*) can be recommended as OPD-level preventive practices for auditory health.
- Future studies should clinically evaluate the protective effect of Panchakarma in noise- and lifestyle-induced auditory disorders.

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