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Improving Hearing Performance through Yoga

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Abstract

Hearing is an essential sense of the individual, which is crucial for verbal communication and social living. With increasing noise pollution, mobile phones, ototoxic drugs, ototoxic chemicals the incidence of old age deafness is on increase. WHO estimates 360 million individuals in the world have disabling hearing loss, of which 91% adults. With the increasing life span we expect the prevalence of deafness as high as 48% above the age of 75 years. By neck muscles (cervical) exercises and deep breathing exercises Kumbhak we can increase the blood and oxygen supply to the inner ear. Hyper note (Ultrasound) sound can stimulate the inner ear. Yoga is a known modality in life style management and de-stressing along with restriction of mobile phone, modification of diet, eliminating Vit D deficiency, we can provide some improvement in sensorineural deafness if not at least we can improve the quality of life by yoga exercises.

Keywords: Ototoxicity; Noise; Ototoxic drugs; Chemicals; Presbyacusis; Pesticides; Vitamin D; Yoga; Holistic approach to deafness; Aasanas; Electro-magnetic field; Life style changes

Introduction

Hearing is an essential sense of the individual, which is crucial for the verbal communication and social living. With increasing noise pollution, mobile phones, Wi-Fi and electromagnetic field due to mobile towers, ototoxic drugs, ototoxic chemicals the incidence of old age deafness is on the increase. WHO estimates 360 million individuals in the world have disabling hearing loss, of which 91% adults and only 9% are children [1]. Disabling hearing loss is >40 dB loss in better ear in an individual above the age of 15 years and >30 dB in better ear below the age of 15 years [2].

The noise, electromagnetic field, diabetes, cervical spondyliosis, hypertension, hypothyroidism, obesity, sinusitis, Eustachian tube dysfunction, Ototoxicity of drugs and chemicals are the few which aggravate the age related sensorineural deafness (Presbyacusis). Noise induced hearing loss is 100% preventable, but once the patient had it, it is for life time Stress which is more in professionals affects the speech discrimination at cortical level in brain [3]. By neck muscles (cervical) exercise and deep breathing exercises we can increase the blood and oxygen supply to inner ear. Hyper note (Ultrasound) sound can stimulate the inner ear.

Though only 9% children suffer from deafness but an attempt must be made to find out the etiological factor. The common factor during pregnancy and child birth includes premature birth, birth asphyxia, TORCH infection, Jaundice and ototoxic drugs.

In familial deafness, Consanguinity is also a precipitating factor which must be kept in mind. In familial deafness option of Preimplantation genetic diagnosis should be highlighted [4,5].

In children Auditory neuropathy should always be kept in mind. It is a hearing disorder where the sound grasped by inner ear is normal but the electrical signal formation and transmission to the brain is impaired. The usual pathology is at the inner hair cells or spiral ganglion. There is extreme poor speech discrimination due to poor functioning of inner hair cells. Parents feel that the baby can hear but is careless hence is delayed management and rehabilitation [6]. Behavioural Observation audiometry is a simple way of assessing the hearing in children below the age of four years and if practiced may be a good priceless way for basic screening. It should be a part of training program of all paramedical courses of all speciality and visual aids to be displayed in waiting area of the hospitals [7] (Figure 1).

With the increasing life span we expect the prevalence of deafness as high as 48% above the age of 75 years [8]. Deafness is not like any other deficiency or disability like impairment of vision or orthopaedic problems which can be corrected in majority of cases while for deafness even after cochlear implantation person remains disabled and needs a lifelong support. We must remember even the best quality hearing aid provides only amplification of sound it does not add benefit in terms of speech recognition hence in old age deafness only 20% people are benefited with hearing aids. This huge population of senior citizen will be a big liability and great socio economic loss. Hence, we have to make all the efforts to prevent this aging hearing loss and if curable to cure it.

The hearing loss can be of two types- conductive (50%) and sensorineural (50%). Conductive hearing loss is a mechanical defect in the conduction from the pinna, external auditory canal, tympanic membrane, middle ear (ossicles, air space) up to annular ligament at stapedial footplate (otosclerosis). Sensorineural hearing loss is most commonly due to involvement of sensory hair cells of the cochlea or sometimes of auditory nerve or the processing centre in the brain [9].

We have to do a massive awareness program to ignite the middle aged persons to go for periodic check-up, government, corporate sectors, nongovernment organizations, social activists and volunteers should actively participate in it. We have to launch an awareness program how to prevent this progressive hearing loss. It is all the more important in patients of Presbyacusis who have familial incidence or working in noisy environment.

The workers of printing press, fuelling station (petrol pump), basic metal industries, chemical industries, pesticides and lead industry are at two-fold higher risk due to noise pollution and chemical toxicity,

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Figure 1: Free field hearing test below two years.

hence these workers should be specifically targeted and made aware and to be prevented from this preventable hearing loss [10].

We have to look for nutritional deficiency, especially for anaemia, Vitamin D deficiency [11,12]. Edentulous senior citizen if encouraged and provided with denture, the quality of life increases many fold apart from improvement in hearing.

Diabetes, incomplete control and management aggravate the neuropathies and hair cells (inner ear) damage.

Hypothyroidism

Uncontrolled hypothyroidism is a known cause of deafness. Its control can lead to some improvement in hearing, addressing to hypothyroidism may also further improve hearing by correcting obesity leading to better Eustachian tube function and restoring normal middle ear pressure and the improvement in hearing [13].

Holistic approach to deafness

In majority of cases we can provide some improvement in sensorineural deafness if not at least we can improve the quality of life by multi factorial approach [14].

Yoga

Various yoga aasanas are helpful in restricting the progressive hearing loss:

- Greeva Chalan
- Skandh Chalan
- Bhramari Pranayam
- Kumbhak

Greeva chalan (neck exercise)

With the growing age there is some degree of reduced blood supply to brain and labyrinth by compression of the vertebral artery due to cervical spondyliosis, which can be minimized by regular cervical (neck) and shoulder exercises.

It is a set of three exercises:

Cervical or neck flexion extension exercise: Start the exercise by tucking the chin in to the chest by gently bringing the head downward. Next gently band the head upward and backward let it go to the maximum with ease (Figure 2A).

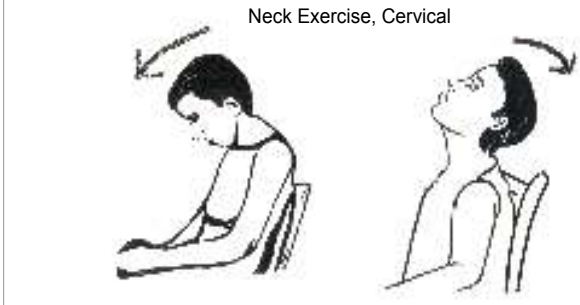

Figure 2A: Flexion extension exercise.

Lateral flexion exercise: Try to touch your right ear to right shoulder then left ear to left shoulder perform alternatively. Do not turn or rotate your head (Figure 2B).

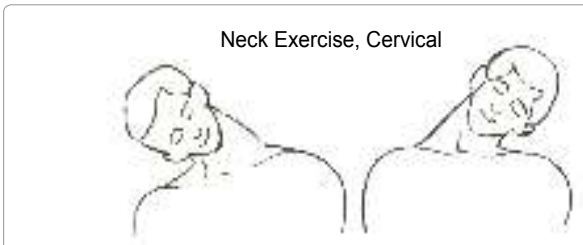

Figure 2B: Lateral flexion of neck exercise.

Head Rotation exercise: Rotate your head first to the right; go back to neutral position then to left. Be gentle but try to rotate to your maximum (Figure 2C).

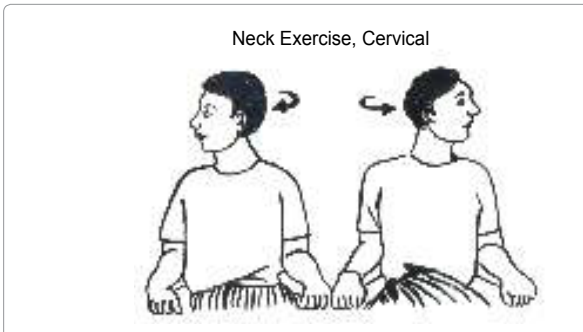

Figure 2C: Head rotation exercise

All these three exercises are performed to the maximum but with ease no overstretching or pain.

Second set of three exercises is performed in the same way but we do not move the head but apply the counter pressure on head by hand to stretching neck muscles (Figure 3A-3C).

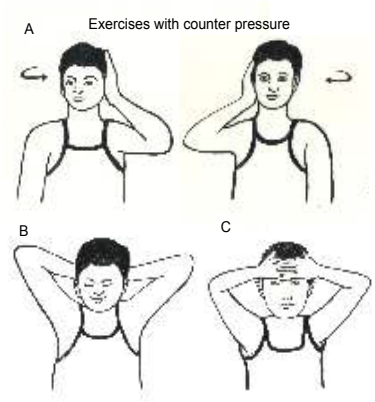

Figure 3: A. Lateral rotation left, righ.
B. Back counter pressure.
C. Front counter pressure.

360° Head rotation exercise

It should be performed initially in sitting posture by rotating the head on neck all 360° starting from tucking the chin into the chest swinging to left shoulder to back then going to left side and coming back forward and downward in initial position.

Do it three times and repeat the exercise three more times starting by rotating the head from right side.

Skandh chalan

Sit comfortably on chair or hard comfortable floor preferably in Sukhasana, put both hands on both knees. Rotate your both shoulder first forward then upward then backward and then downward completing one cycle (Figure 4A-4D).

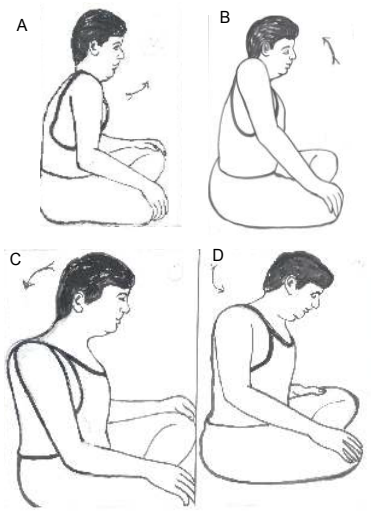

Figure 4: A. Anterior [Shoulder exercise, moment from]
B. Superior
C. Posterior
D. Inferior/Neutral

Do it 21 times repeat the shoulder exercise in reverse direction; first shoulder should go down posterior, superior and coming anteriorly completing one cycle. Do it 21 times.

Now do alternate rotation when your right shoulder is up and left shoulder is down and when right is forward the left is backward. Do it 21 times.

All the asana give better result if performed on after holding a deep breath.

Bhramari pranayama (bee breath)

Human can detect ultrasound but perception requires direct contact of the sound source with the body which sets the brain and base of the cochlea in to forced vibration. It provides relief in long term tinnitus by stimulating the hair cells through neural reprogramming, hence sound generated in Bhramari Pranayama specially Shanmukhi Pranayam vibrates the skull and brain tissue inside, may also act on cochlea through the third window of Ranke (Cochlear Aqueduct) [15].

It is a breathing exercise; a humming sound is produced during exhalation with an effort to generate the echo in the ears. In modern medicine higher frequency sounds (ultrasound therapy) is a known modality in treatment of tinnitus and sensorineural deafness. Apart from restoration of hearing by stimulating the hair cells and generating action potential, Bhramari Pranayama is also quite effective in de-stressing.

The exercise should be performed sitting comfortably in calm place with eyes closed, and in a relaxed mood with a smile on face. Place your index finger gently in the ear canal or on tragal cartilage, to block the ear canal. Take a deep breath and as you slowly exhale make a loud humming sound and generate echo, focus your attention towards the inner ears. A high pitch sound gives better results. It also helps in regaining better speech recognition (Figure 5).

Figure 5:

Shanmukhi Mudra is modification of Bhramari Mudra for better and earlier improvement. Procedure is place both your thumbs at tragal cartilage or at inlet of external auditory canal, both side index fingers on the forehead just above the eyebrows, middle fingers on the eyes, ring fingers on the nostril and little finger on upper lip. A deep breath is taken, tuck your chin into chest, and close your mouth with ballooning of cheek. A high pitch humming sound is produced (Figure 6A and 6B).

A Shanmukhi Mudra

B Shanmukhi Mudra

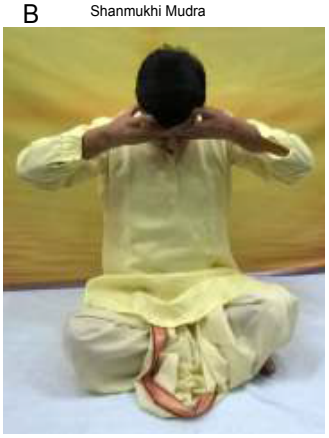

Figure 6:

Kumbhak

Kumbhak is a respiratory exercise which can be justified scientifically. Carbogen therapy is a known treatment in cerebral atrophy, sensorineural deafness and Alzheimer's disease. In Carbogen therapy, we provide 5% carbon dioxide (CO_2) as a stimulant which is known to work as a vasodilator and increases arterial oxygen concentration and the blood supply along with oxygen supply to the injured hair cells of cochlea [16]. In Kumbhak we exhale the air from the lungs for the maximum time and capacity hence increase the blood CO_2 level which leads to stimulation and regeneration of higher centres including hearing area.

In this exercise as shown in posture, (Figure 7) sitting comfortably in Sukhasana or on chair with straight trunk and spine, index and middle finger rest on the forehead between the eyebrows, thumb on right ala of nose and right ring finger tip on left ala of nose. The exercise starts with slow, gradual deep inhalation to the maximum from left nostril with counting the digits 1 to 10 (duration 1 Unit) filling the lungs entirely. The breath is kept on hold by closing both nostrils and counting 11–50 (duration 4 units), followed by exhalation from right nostril counting 51–70 (2 Units).During exhalation left nostril will remain closed by right ring finger and from right nostril thumb will be withdrawn. In deep exhalation every bit of air is drawn out forcefully, now both nostrils are closed again for 10 counts from 71 to 80 (1 Unit). One cycle is complete in 8 Units inhalation (one unit) breath holding (four units) exhalation (2 units) cessation of breath one unit. Time of unit exercise can be modified as per body strength (Figure 7A-7C).

Kumbhak

Figure 7A: A Front view.

Kumbhak

Figure 7B: Left Side view.

Kumbhak

Figure 7C: Right Side view

Breathing through the right nostril is supposed to increase the blood circulation and vitalize the body known as Surya nadi (Pingala nadi) if Kumbhak is performed only from right nostril is termed as Surya Bheda Pranayama. In this yoga while holding the breath the chin is tucked in the sternum (Jalandhara bandh). It also clears the sinuses and prevents or delays the age related decay of aging body and body organs

Shankha naad

Blowing a Shankha (snail pipe) is a powerful respiratory exercise; it tones up the muscles of respiratory passage.

The shape of Shankha (snail shaped) resembles the shape of cochlea (organ of hearing). The sound of Shankha is said to stimulate all the hair cells in inner ear, hence helps in preventing the aging hearing loss. By toning up respiratory tract muscles, it helps in reducing the snoring and obstructed sleep apnoea.

How to blow shankha (conch shell)?

Your back must be straight and your neck and head upward and slightly backward.

For blowing Shankha take a deep breath and concentrate on blowing, close your eyes. During blowing gradually increase the force hence generates pitch from the low to high frequency. Longer is the duration more is the stimulation and more positive energy generated, resulting in prevention of deafness and enforcement in hearing (Figure 8A and 8B). Apart from stimulating the ear blowing of Shankha can improve the vital capacity and said to correct the speech defects and respiratory diseases.

A Shankha Naad

B How to Blow Shankha

Figure 8:

Mudras

Shunya mudra

It is a posture known to increase the power of hearing in normal person and for spiritual awakening. The posture is by sitting comfortably preferably in Sukhasana/Padmasan but may be performed sitting on chair with straight trunk and spine. Bend over the middle finger and its tip should press/dig into the ball/base of the thumb. Now gently thumb should press the middle phalynx of the finger, rest of the finger should be stretched and straight. Mudra should be done by both hands synchronously. Shunya Mudra is said to be beneficial also in vertigo and thyroid disorder (Figure 9A and 9B).

A Shunya Mudra

B Shunya Mudra

Figure 9: Inset view of left hand.

Gyan mudra

This is a simple Mudra, formed by joining the tips together of index finger and thumb. Sit comfortably in Sukhasana with straight trunk and spine no exertion relaxed as in Shunya Mudra. Mind and thought process is relaxed. Apart from regenerating the cerebral cortex and hearing area it is effective in loss of memory, cerebral palsy, diabetes, Alzheimer's disease and hypothyroidism (Figure 10A and 10B).

A Gyan Mudra

B Gyan Mudra

Figure 10: Inset view of right hand.

Drugs and chemical toxicity

Ototoxicity is "the side effect of certain therapeutic agents and other chemical substances, whether topical or systemic, to cause functional hearing impairment and cellular degeneration of the tissues of the inner ear, especially of the end-organs (hair cells) and neurons of the cochlear and vestibular divisions of the eighth cranial nerve" [17].

Major pharmacological groups recognized as being ototoxic to humans include aminoglycosides, macrolides, glycopeptide antibiotics such as chloramphenicol ampicillin, vancomycin, cytotoxic agents used in chemotherapy (i.e., cisplatin), loop diuretics, acetyl salicylic acid (ASA), nonsteroidal anti-inflammatory drugs (NSAIDs), topical antiseptics (i.e., chlorhexidine), alcohol, povidone iodine, neomycin, anti-malarials (i.e., quinine, chloroquine), iron chelating agents (i.e., deferoxamine), etc [18].

Few other agents that are potentially ototoxic include propylene glycol (a common combination of ear drops), methyl mercury, potassium bromate, industrial solvents (styrene and toluene), propranolol, propyl thiouracil, bleomycin, nitrogen mustard, carbon monoxide, tetanus antitoxin, gold, lead, arsenic, alcohol, nicotine, caffeine, and Marijuana [17].

Alcohol in paints, adhesives in industry and computers, propane, kerosene, automotive diesel and Gasoline jet fuel (JP-8) which contains aromatic hydrocarbons, toluene, and styrene and ethyl benzene all lead to chemical toxicity mainly affecting the 1st row of outer hair cells.

Carbon monoxide, apart from poisoning and other symptoms, can aggravate deafness in potentially hearing impaired persons hence gas water heater, barbeque, oven, charcoal heater (kangri in Kashmir), room heaters and electric generators should be avoided in closed rooms.

Butyl or ethyl acetate transfluthrin used as insecticide/mosquito repellent must not be used with door & window closed and should never be used in airtight air-conditioned rooms due to risk of chemical toxicity and deafness Spray perfumes should be discouraged in potential patients.

Chlorhexidine is an OTC product used worldwide in hand washing; wound cleaning and in oral rinse. Chlorhexidine can potentiate progressive sensorineural hearing loss along with other risk factors.

Electro-Magnetic Field (EMF)

EMF generated by WIFI, cell phones, remote control devices; television, microwave ovens and other radio devices can affect the individuals. The microwave pulse is absorbed by the soft tissue, launches thermoplastic waves of acoustic pressure reaching the inner ear via bone conduction and stimulates the cochlear receptors. The response may vary in individuals but EMF may lead/aggravate the tinnitus, hearing impairment, vertigo, Meniere's disease, acoustic neuroma apart from leading to irritability, epilepsy and autism. EMF may also lead to DNA mutation and birth defects in foetus if a pregnant woman is exposed. WHO has also classified EMF as a possible cause of acoustic neuroma. Children are affected more with cell phone radiation [19].

Preventive Measures- For EMF

1. Bed should be away from the electrical appliances and all electrical devices which are not in current use should be turned off specifically at night.
2. Digital clock/alarm clock and heating pads should be avoided by the potential sufferers.
3. WIFI should always be kept in auto switch off mode.
4. Teenagers should be discouraged to use mobile phones and complete NO to music on mobile phones. Same is for pregnant women to avoid fetal malformations and impairment of hearing in fetus.
5. Encourage use of land line (wired) phones. Remove all metal beds and chairs in use or in vicinity as metal attracts and magnify the EMF.
6. Office and bed room in potential cases may be made EMF free zone by installing radiant barrier aluminium foils.

Life Style Changes

Restriction of aggravating factors in diet which increases mucous in the body like dairy products, alcohol, coffee, black tea, processed food prevent deafness.

Avoid exposure to cold including frequent change of temperature, which may aggravate the sinusitis and Eustachian tube dysfunction.

Smoking and tobacco chewing is known to affect the hearing hence a wide awareness program should be launched to make the public aware that it does not lead only to malignancy or tuberculosis, it also leads to deafness. Public must be made aware that passive smoking (smoking in the house) may lead to all the complications as to a smoker, and may be even more in passive smoker.

Over exhaustive use of mobile phone may lead to hearing loss hence restricting its use prevents sensorineural hearing loss specially in Presbyacusis cases [20,21].

Diet

Foods rich in omega 3 fatty acid prevents aging hearing loss, strengthens the blood vessels. Antioxidants and folic acid if cannot cure certainly prevents or delay the progressing hearing loss. Common food as fish salmon, spinach, asparagus, broccoli, beans, liver, eggs, and nuts are good source. Low level of magnesium in the perilymph (Fluid in the inner ear) may cause energy depletion and irreversible damage to the hair cells; banana, potato, and broccoli are the sources. Zink supplement is said to prevent aging deafness. Papaya, whole grain, dark chocolate, peas are the source. Vitamin C boosts up immune system. Lemon, oranges, citrus fruits, and Amla (gooseberry embica) are the good source. Potassium level decreases with age and its depletion affects hearing, bananas, melons, orange and spinach are the source.

Mucous producing foods, dairy product, starch, carbohydrate, processed food, alcohol are said to aggregate the aging hearing loss while leafy green vegetables, if not cure prevent the progressive hearing loss. Correction of Vitamin D deficiency corrects the calcium level in labyrinth hence delays age related hearing loss and generation of better action potential in cochlea [11,12].

Conclusion

The old age hearing loss may be associated with shrinkage of superior, middle and inferior temporal lobe gyri of brain, responsible for processing of sound and speech which may be a pointer of developing dementia. Males are three times more prone to noise induced hearing loss hence to more prone dementia.

The deafness in old age is mostly cochlear due to damage to hair cells. These damaging of hair cells can be prevented by neural plasticity triggered by the signals of Shankha Naad and Bhramari Pranayam by their hyper note ultrasonic sound generated with echo by conduction inside the skull. Hence a multifactorial approach by Change in life style including restriction of mobile phone, modification of diet, eliminating Vitamin D deficiency, and Yoga is the only remedy to prevent a worldwide disastrous epidemic of deafness which we have to face in the times to come.

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