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RESEARCH ARTICLE

EFFECT OF SNAGS TECHNIQUES ON HEARING ABILITY AMONG THE PATIENTS WITH UPPER CERVICAL DYSFUNCTION

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Abstract

Background: Cervical spine is the upper most vertebral segment which is responsible for the weight transmission of head and brain, the cervical spine is divided into the upper and lower part. Any dysfunction to the cervical spine may lead to the misalignment to the vertebra commonly upper cervical joint complex. Many vital structures travels or passes through the cervical spine/ cervical vertebra / upper cervical joint complex, vertebral artery is the one of the important structure pass through it. There is a close relationship between the upper cervical (sympathetic) ganglion and C_1-C_2 spinal nerve, any pathological changes or dysfunction of the cervical spine including degeneration of the both disc and vertebra can cause sympathetic nerve irritation which lead to sympathetic symptoms. It may affect the hearing ability.

The Aim of the study was to investigate the effects of SNAGS techniques on hearing ability among the patients with upper cervical dysfunction.

Methodology: 62 subjects participated in the study. Hearing frequency was taken as an outcome measure which was recorded with u-Hearing audiometery app (Pure tone audiometery) prior to SNAGS techniques is given to the patients C_1-C_2 vertebra to the side it was stuck. The hearing frequency was compared with the post intervention hearing frequency. Data was analyzed using graph pad method. Descriptive statistics was used to summarize the variable. The paired t- test was done to see the effects of intervention on hearing ability /hearing frequency in our study population.

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Result: In this study we found the change in variables as observed with the mean of hearing frequency of the participants before the intervention was pre value of 25.98±4.25(Right Ear) , 26.71±4.35(Left Ear) and after the intervention the mean post value of 3.21±4.05(Right Ear) , 24.2±3.90(Left Ear).The result is significant at $p<0.05$

Conclusion: In this study, it was concluded that SNAGS techniques was significantly effective in improving the hearing ability in the patients with the cervical dysfunction.

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Introduction:-

The Cervical-Spine is divided into the upper and lower parts. The upper neck or cervical consists of the occiput and the 1st vertebrae. [1] The atlas vertebra i.e. C_1 has unique anatomy due to the absence of vertebral body & its ring like shape which makes it's different from other cervical vertebrae. Absence of the vertebral body is replaced by two lateral masses that are joined together by a short anterior arch & a long posterior arch. At the level of C_1 vertebra, the vertebral artery (VA) exits from the transverse foramen & course to spinal canal & posterior to its lateral masses. [1]

Any abnormality of cervical spine especially upper cervical spine can affect the arteries or nerves related to the ear and disturb their function through different mechanisms [1]The C-Spine dysfunction is a common condition, represented by a group of signs & symptoms that involve pain & limitation of rang of the physiological movement's tenderness or pain on cervical muscle at palpation. Variety of reason for cervical spine pain apart from obvious trauma or a history of trauma. These include postural or degenerative causes. An increasing proportion of the population spend long periods sitting or its sustained position. This occurs in both the works and social environment which in fact, in creating an increase in there types of conditions seen. 68% of the patients with cervical dysfunction suffer from hearing disorder.[2][3]

The hearing impairment following the cervical spine disease (such as OA, RA, Disc herniation at upper cervical segment etc) may appear as hearing loss, vertigo and tinnitus. [3][12] Cervical spine dysfunction may lead to misalignment most commonly of upper cervical joint complex. Many vital structures pass through the upper cervical joint complex, one of the most important vertebral artery. [2][3]

In 1926 Barre proposed that the symptoms like headache, vertigo and auditory were related to alteration in the posterior cervical sympathetic chain and vertebral artery blood flow in patient with cervical spine arthritis and other related disorder of cervical spine (upper cervical spine)[3]Instability in the neck has also been shown to be potential factors for cervical vertigo & auditory changes. Pathological changes of the C-spine including degeneration of both the disc & vertebra can cause sympathetic nerve irritation & lead to sympathetic symptom as shown in both human and animal studies. [3]

There is a close relationship between the upper cervical (sympathetic) ganglion and C_1-C_2 spinal nerve. The sympathetic nervous system has its connection with cervical nerve roots through the upper two thoracic nerves which joint cervical part of the sympathetic trunk via their anterior primary rami and proceed upward to the cervical ganglia. Gray rami communication pass from the superior cervical sympathetic ganglia to the anterior rami of the upper 4 cervical nerve. Few of post ganglion fibers reach the vestibular portion of the ear by way of the plexus surrounds the vertebral artery and fibers which extend to basilar artery & internal auditory branch[4] The C_1 –C_2 facet joint are innervated by the C_1-C_2 anterior primary rami. Posterior rotation of the shoulder with the head fixed position will activate a cervical sympathetic reflex if the joint of the upper cervical spine and dysfunctional. It has been known since 1957 that the sympathetic nerves innervate the Eustachian tube.[3]Any sudden up guarded motion of neck or prolonged relaxation of the neck in an abnormal position may cause a subluxation with actual locking of facets on one side. [3]

Cervical spine pain is a common ailment seen these days. Medically this is often diagnosed by radiography and treated with anti-inflammatory medication. While medication assists in short term pain relief, symptoms relief, and masking of pain, it does not address or treat the underlying causes of cervical spine dysfunction. Therefore

numerous techniques such as muscle energy techniques, chiropractic manipulation , Maitland mobilization, stretching and myofacial release, kneading, SNAGS , NAGS, MWM'S, Tractions etc have now been developed for correction of misaligned spine.[5][6]

SNAGS is techniques with first opens and then compresses the zygapophyseal joint ipsilateral to side of pain, and perhaps slightly distracts the uncovertebral cleft.[5][6]The therapist applies the appropriate accessory zygapophyseal gilds while the patients perform the symptomatic movement. This must result in full range pain free movement. SNAGs are most successful when symptoms are provoked by a movement and are not multilevel. They are not the choice in condition that are highly irritable.[6][7][8] Although SNAGS are usually performed in weight bearing position they can be adapted for use in non weight bearing positions [5]

Audiometery (Pure Tone Audiometery):
Audiometery is a relatively simple procedure that can be performed and interpreted by a health care professional. When hearing loss is suspected, pure tone audiometery is used to elevate hearing deficits by spot checking certain frequency/ frequencies or evaluate deficits more completely. Pure tone audiometery is performed with the use of and audiometer or and an audiometery application.[9][10] There are several type of audiometers available, all function similarly by allowing the tester to increase & decrease the intensity (loudness or decibels (db) & frequency/pitch in cycle per seconds or Hz) of the single desired.[7][8]

Sound frequency (Ranging from low to high pitch) is recorded on the audiogram horizontal axis, sound intensity is recorded on the vertical axis, right ear thresholds recorded as a red circle "0" on the audiogram. Left ear thresholds are recorded as blue "X".[8] uHear, an application used for self administered audiometery was validated in the highest number of peer reviewed studies against gold standard pure tone audiometery.[7] uHear, ios it is self administered audiometery application test frequency 0.25, 0.5,1,2,3.. Kilo hertz, it's calibrated with standard head phone using reference equivalent threshold sound pressure level for TDH39 head phone (iso389-1). Transducers type air conduction (AC) is measured but not bone conduction (BC). Noise monitoring data storage with user identification & questionnaire to elevate the impact of hearing loss. [8]

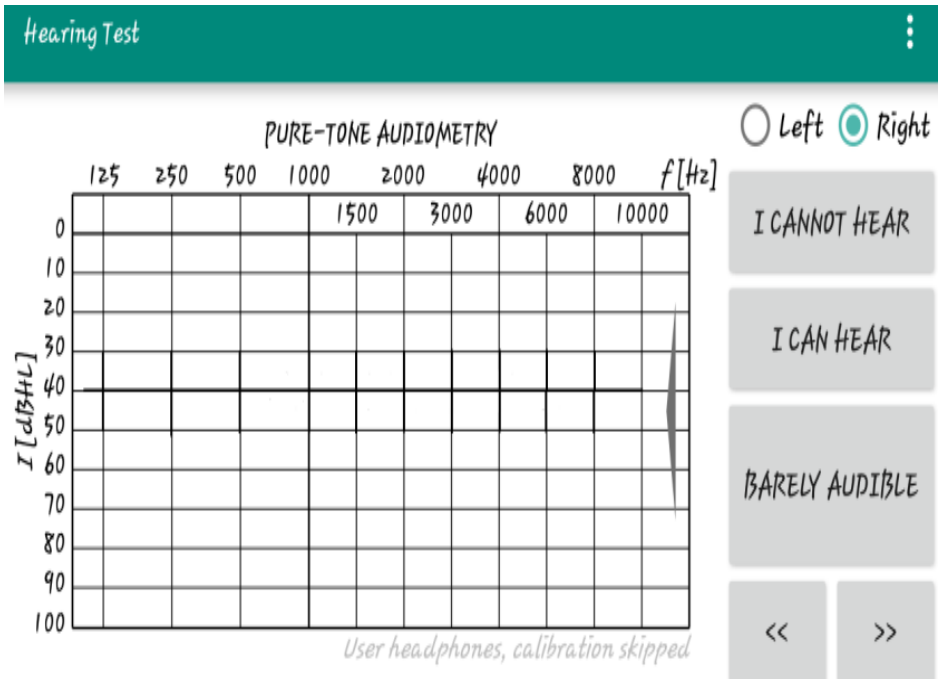

Figure Showing:- u-Hearing app (pure tone audiometery).

Material & Methods:-

This was an experimental study to determine the effects of SNAGS techniques on hearing ability / hearing frequency among the patients with upper cervical dysfunction. Prior to starting of the study, ethical approval was taken. A list of total 141 subjects was made, 70 subjects was selected by random sampling in which 8 subjects were used in pilot

study to iron out unforeseen faults in procedure, after that total 62 (subject) sample size. Subjects between age limits of 20-60 year drawn with cervical spine dysfunction due to rotational fault of C_1-C_2 vertebra. Subjects were selected from a private set up of health care in 2017. Subjects with fracture of cervical spine, any diagnosed medical and surgical condition in which the SNAGS techniques cannot be used, systemic diseases affecting the vertebral segments. Muscle pathology i.e. strain, uncooperative patients were excluded from the study. Subjects was suggested to use ear drop (murine/mollifene) to soften the wax in their ear and then asked to clean with ear bud or cotton. Detailed procedure is explained to the participants following which the written informed consent was taken. Patients made to sit in a room where there is minimal sound or noise, so that the noise doesn't influence the hearing frequency for reading with pure tone audiometer (u-Hearing app). Motion palpation done for cervical vertebrae to check the side of stuck C_1-C_2 vertebrae. Pre intervention Hearing frequency ability is recorded with u- Hearing app (application). SNAGS technique is given to the participants on their affected side (3 sets of 8 repetitions) are performed; post intervention hearing frequency is measured after the SNAGS techniques given with u-Hearing app. Data recorded and analyzed, the data was analysed with using graph pad. Descriptive statistics was used to summarized the variable paired t-test was used to see the effects of intervention on Hearing ability/ hearing frequency in our study populations p value <0.005 considered significant.

Result:-

Total 62 subjects participated in the study with age of mean 37.46±8.96. The gender distribution in our study was 53% female and 47% were male. With the mean of hearing ability of the participants before the intervention was pre value of 25.98 ±4.25 (Right ear), 26.71±4.35 (Left ear) and after the intervention the mean post value of 23.21±4.05 (Right ear), 24.2±3.90 (Left ear).The result is significant at p<0.05.

	Mean±S.D	
	Right ear	**Left ear**
Pre Intervention	25.98±4.25	26.71±4.35
Post Intervention	23.21±4.05	24.2±3.90
P Value	0.000267	0.000502

Discussion:-

This study was designed to check the effect of SNAGS techniques on hearing ability among patients with upper cervical dysfunction. This study was conducted on 62 subjects with cervical dysfunction. The mean age of the participants was 37.4 in which there were 53.2% of female and 46.7% male. Similar study was conducted by Wendy Rheault chirrs byres et al(1992) where the purpose of the study was to investigate the Intertester reliability of the cervical range of motion device consisted of 22 subjects (15 female and 7 male) and they even concluded that the females were more prone to cervical dysfunction [13]Behnoosh vasghi-gharamaleki et al. looked at the risk of hearing impairment following the cervical spinal disease by measuring the cervical range of movement with 53% of subjects had bilateral hearing loss, there was significant correlation was observed between hearing loss and ROM limitation of rotation to the left.[1]

Melissa Ferranti et al. In his study, a reported case from Germany a 36 year old soccer player hit his head with the ball and had sudden hearing loss in the right ear. After a single manipulation to the thoracic spine, the right sacroiliac joint and the right side neck (C_1 –C_4) his hearing immediately improved. There are several possible mechanisms to explain how cervical sensory motor may affect hearing. One of these is cortical neuroplasticity which is an important property of the auditory system. Central plastic changes are most likely the result of relatively simple alteration in the balance of excitory or inhibitory input produced by manipulation. There may also be central plastic changes which occur in the brainstem at the level of the vestibular nerve.[7]

Some authors presented an idea of the existent of a "Vertebrgenic hearing disorder" that comes with tinnitus, a feeling of ear pressure, otalgia, and deafness due to functional deficit of the upper cervical spine. They concluded with issue like cervical vertigo and hearing disorders in 15% of patients with cervical spine issue and hearing losses of 5 to 25 decibels in 40% of them. Cervical dysfunction can affect the ear vessels or nerves resulting in hearing loss, vertigo and tinnitus.[3] It has been seen that cervical dysfunction can trigger pain and limits in range of motion.[3][14]

Further, there is indication of interaction between the somato sensory and auditory brainstem structures, a pathway joining the cervical spine to hearing function. Many researchers have found projection from C_2 dorsal root ganglion stretching to the cochlear nucleus. [14]

Manual therapy is often used for the management of cervical dysfunctions. Systemic review of randomized control using manual therapy in any type of cervical dysfunction, patients suggest better outcome. Results of this study demonstrated efficacy of the SNAGs techniques in reducing the hearing loss symptoms in patients with cervical dysfunction. According to gate control theory, stimulations of mechanoreceptors within the join capsule and surrounding tissue cause an inhibition of pain at the spinal cord. In case of the increase in cervical rotation range, mobilization most likely decreased joint stiffness, break down the adhesions and stretch surrounding tissue.[15][16]

As compared to other technique SNAG can be given in sitting or standing which has advantage when improvement take place in functional posture they are more likely to be retained [5][16][17] SNAG is a pain free techniques where other technique like manipulation etc. are painful and can have serious complication if not done correctly and can cause increase in pain and may cause hearing loss and other symptoms.[5][14][17][18] This show that our intervention has resulted significant changes in the hearing ability which in turn that the misaligned upper cervical can result in sympathetic disturbance.

Conculsion:-

In the study, it was concluded that SNAG technique was significantly effective in improving the hearing ability in patients with cervical dysfunction.

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