

Evaluation of Correlation Refractive Status and Hearing Loss with Age

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ABSTRACT

Introduction: Ageing is a physiological phenomenon. Human biologic functions usually peak at about the middle of the third decade of life and thereafter begin a slow deterioration, moreover all body organ tend to lose functional cells, which are replaced by fibrous or fatty tissue. Thus, the present study was conducted to study the correlation of refractive status and hearing loss with age.

Material and methods: The Study was commenced among 60 patients reporting to the Eye OPD. Total 120 eyes and 120 ears were examined among selected patients in age between 40-75 years was carried out. Distant vision was tested by Snellen's chart at a distance of 6 meters. Near point of accommodation and amplitude of accommodation was measured with Royal Air Force Rule, marked with centimetres and Dioptre values respectively. Pure tone audiometry was performed to find out the severity of hearing loss. Obtained data was arranged according to characteristics and was expressed as a number and percentage of respondents and were analyzed using the SPSS Version 17 software.

Results: It was evident from the study that near point of vision recedes and amplitude of accommodation decreases with the increase in age. Majority of cases i.e.66.7% in group I were emmetropic whereas in group II, III, and IV were ametropic i.e. 66.7%, 80% and 80% respectively. Thus ametropia increases with the advancement of age. Mean prescribed presbyopic addition in group I was 1.50DS, in group II was 2.25DS, in group III was 2.75DS and in group IV was 3.25 DS. It was evident from the audiometric patterns that cases had gradual increase in loss of hearing with advancing age. Severe loss was observed in group IV.

Conclusion: Both the condition of presbyopia and presbycusis increased gradually with the age.

Keywords: Refractive Status and hearing, hearing Loss with Age

INTRODUCTION

Ageing is a physiological phenomenon. Human biologic functions usually peak at about the middle of the third decade of life and thereafter begin a slow deterioration, moreover all body organs tend to lose functional cells, which are replaced by fibrous or fatty tissue.¹

Presbyopia is a condition that occurs with growing age and results in the inability to focus near objects. It is characterized as a progressive age related loss of amplitude of accommodation. Progression of presbyopia begins early in life and complete loss of accommodation usually culminates by age of 50 years.² The crystalline lens is of ectodermal in origin and continue to grow throughout the life. The distance between the ciliary muscle and the equator of lens decreases throughout the life. Therefore, the effective force that the ciliary muscle can apply to the lens equator is reduced in a linear fashion with age. Therefore, amplitude of accommodation decreases linearly with age. Thus

presbyopia occurs because of continued growth of lens and consequential slackening of zonular fibres, which could prevent ciliary muscle from increasing equatorial zonular tension during accommodation.³

Presbycusis is the most common reason for hearing deficit in the elderly. The clinical presentation varies from patient to patient. A typical patient may have more difficulty in understanding language that is spoken rapidly, vocabulary that is less familiar and more complex. The audiometric finding and pathomorphological picture varies considerably, the kind and degree of hearing loss is distributed widely across each age. The speed of onset of degenerating change in the ear is determined by genetic factors and by physical stress to which it is subjected during a normal life span.⁴

There are four basic types of presbycusis: Sensory, Neural, Metabolic and Mechanical. Sensory presbycusis is characterized by degenerative and atrophic changes at basal end of the cochlear duct of the organ of corti. Neural presbycusis is characterized by degeneration of spiral ganglion at basals coil of cochlea as well as of neurons of higher auditory pathway. Metabolic presbycusis is due to defect in the physical and chemical processes by which energy is produced and made available for use by the sense organs. Mechanical presbycusis is caused due to disorder in motion mechanics of the cochlear duct which is caused by stiffening of the basilar membrane.⁵ Zwaardemaker was first to recognize on pure tone audiometry that in presbycusis there is impairment of hearing for high pitched sounds.⁶ Later on Bunch demonstrated quantitatively the progressive diminution of hearing activity for pure tones, particularly of high frequencies, as a function of age.⁷ Thus, the present study was conducted to study the correlation of refractive status and hear loss with age.

MATERIAL AND METHODS

The Study was commenced among 60 patients reporting to the Eye OPD. Total 120 eyes and 120 ears were examined among selected patients in age between 40-75 years. These Cases were divided into 4 groups according to age with 15 patients in each group. Group 1 includes cases with age between 40-48 years, Group II includes cases with age between 49-57 years, Group III includes cases with age between 58-66 years and Group IV

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includes cases with age between 67-75 years. Distant vision was tested by Snellen’s chart at a distance of 6 meters. Near point of accommodation and amplitude of accommodation was measured with Royal Air Force Rule, marked with centimetres and Dioptre values respectively. The test was done monocularly, measurement was done with the distant manifest refraction in place and root of nose was taken as point of reference. The near point card attached on the ruler was presented at distance of 50 centimetres, as the card was drawn nearer toward eye the point where blurring of smallest letter starts is noted and measured in centimetres and dioptres. Any person with near point more than 30 centimetres was considered as a case of presbyopia. Near vision was tested by Snellen’s near point card.

Pure tone audiometry was performed to find out the severity of hearing loss which was characterized as Non significant if hearing loss was 0-25 decibels, Mild if hearing loss was 26-40 decibels, moderate if hearing loss was 41-55 decibels, moderately severe if hearing loss was 56-70 decibels, severe if hearing loss was 71-90 decibels, profound if hearing loss was

above 91 decibels.

STATISTICAL ANALYSIS

Obtained data was arranged according to characteristics and was expressed as a number and percentage of respondents and were analyzed using the SPSS Version 17 software.

RESULTS

The mean amplitude of accommodation in group I was 2.89 D, in group II 2.10 D, in group III 2.0 and in group IV less than 2. It was evident from the study that near point of vision recedes and amplitude of accommodation decreases with the increase in age (Table-1). Majority of cases i.e.66.7% in group I were emmetropic whereas in group II, III, and IV were ametropic i.e. 66.7%, 80% and 80% respectively (Table-2).

Mean presbyopia addition in group I was 1.50DS, in group II 2.25DS, in group III 2.75 DS, in group IV was 3.25 DS (Table-3).

The pure tone average at 4KHz in group I was 26/22 in right ear, 27/21 in left ear; in group II was 30/26 KHz in right ear, 30/27 in left ear; in group III was 55/44 in right ear, 47/40 in left ear and in group IV was 58/47 in right ear, 58/49 in left ear, the pure tone the average at 8KHz in group I was 26 in right ear, 27 in left ear; II 34 in right ear, 33 in left ear; in group III was 56 in right ear, 52 in left ear and in group IV was 71 in right ear and 71 in left ear.

The case in group I showed mild hearing loss, in group II showed moderate hearing loss, in group III showed moderately severe hearing loss and in group IV showed severe hearing loss. It is evident from the audiometric patterns that cases had gradual increase in loss of hearing with advancing age. Severe loss was observed in group IV (Table-4).

DISCUSSION

Some loss of visual efficiency with age is universal.⁸ 21% of the people have both vision and hearing loss by the age of seventy.⁹ Dual sensory loss in elderly has significant effect on an individual ability to socialize, communicate with others and live independently.

Vigi F¹⁰ found mild hearing loss in 20% of cases in age group of thirty to fifty years, 38% of cases in age of more than fifty had moderate hearing loss and 43% had severe hearing loss. In the present study it is evident from the patterns that there is gradual increase in loss of hearing with advancing age. Severe loss was observed in group IV of 65 -72 years of age.

The present study showed the preponderance of females for presbyopia and preponderance of males for presbycusis. This study was in agreement with the observation of Jager et al.¹¹ Although presbyopia is commonly defined as the loss of

Groups	Mean near point of accommodation (cm)		Mean amplitude of accommodation(dioptres)	
	Right eye	Left eye	Right eye	Left eye
I	34.26	34.26	2.89	2.89
II	46.33	46.33	2.10	2.10
III	48.75	48.75	2.0	2.0
IV	>50	>50	<2.0	<2.0

Table-1: Near Point of accommodation and amplitude of accommodation

Groups	Total eyes	Emmetropia	Ametropia
I	30	20(66.7%)	10(33.3%)
II	30	10(33.3%)	20(66.7%)
III	30	6(20%)	24(80%)
IV	30	6(20%)	24(80%)

Table-2: Refractive Status

Groups	Eye	Mean presbyopic addition (+DS)	
		Calculated	Prescribed
Is	Right eye	1.46	1.50
	Left eye	1.46	1.50
Ii	Right eye	2.26	2.25
	Left eye	2.26	2.25
Iii	Right eye	2.78	2.75
	Left eye	2.78	2.75
Iv	Right eye	3.25	3.25
	Left eye	3.25	3.25

DS- dioptre sphere

Table-3: Presbyopic addition

Groups	Mean loss at 250, 500, 1000, 2000, 3000 hz		Mean loss at 4000 Hz		Mean loss at 8000 Hz	
	Rt. Ear	Lt. Ear	Rt. Ear	Lt. Ear	Rt. Ear	Lt. Ear
	AC/BC	AC/BC	AC/BC	AC/BC	AC	AC
I	22/16	21/16	26/22	27/21	26	27
II	25/20	23/20	30/26	30/27	34	33
III	38/26	32/26	55/44	47/40	56	52
IV	37/30	40/31	58/47	58/49	71	71

AC-Air conduction, BC-Bone conduction

Table-4: Pure Tone Audiometry

focusing ability with age, the detection of presbyopia and need for near-vision correction is dependent on not just the loss of focusing ability but also on the habitual reading distance and the depth of focus. Based on the findings of this analysis, there is no significant sex difference in accommodative amplitudes, a direct measure of focusing ability.¹³

There are number of theories to explain accommodation. Some of these are related to lens and its capsule others to ciliary muscle. Scheiner proved that accommodation occurs as a result of a change in optical power of eye.¹⁴ Helmholtz VH observed that in addition to anterior and posterior surface of the crystalline lens becoming more convex, the lens becomes thicker during accommodation.¹⁵ In another study, Helmholtz showed that accommodation occurs when the ciliary muscle contracts to release the resting zonular tension on the equatorial edge of the lens.¹⁶

According to theories of presbyopia, when zonular tension is released, the lens capsule is unable to exert sufficient force on hardened lens substances to cause the lens to become accommodated and the hardening of the lens substances could cause presbyopia.¹⁷ The total area of the ciliary muscle decreases with age and ciliary muscle of the old human eye looks like the accommodated ciliary muscle of the young eye and could contribute to presbyopia by reducing the functional range of muscle contraction.¹⁸

Near point of accommodation and amplitude of accommodation was measured with Royal Air Force Rule. It was evident from the study that near point of vision recedes and amplitude of accommodation decreases with age. This is in agreement with the study done by Schachar et al.¹⁹

In the present study it was found that ametropia increases with the advancement of age. This is in conformity with the observation of Gitting et al,²⁰ who observed that visual acuity of the elderly subjects was worse than their young counterparts for both near and far test distant.

In present study mean prescribed presbyopic addition in group I was 1.50DS, in group II was 2.25DS, in group III was 2.75DS, group IV was 3.25 DS. Blystone PA²¹ in his study found that presbyopic addition increases rapidly in patients from age of 40 to 50 years of age and then presbyopic addition increases slowly.

In the present study, 20% of the cases in group I, 40% of the cases in group II, 60% of the cases in group III, and 80% of the cases in group IV had recognizable hearing loss more so at higher frequencies. The cases in group I showed mild hearing loss, in group II showed moderate hearing loss, in group III showed moderately severe hearing loss and severe loss was observed in group IV. It was evident from the audiometric patterns of the present study that the cases had gradual increase in loss of hearing with advancing age.

CONCLUSION

Both presbyopia, presbycusis is a normal consequence of ageing and both the condition increased gradually with the age. The possible etiological reasons for presbyopia and presbycusis seem to be due to some changes in the size of blood vessels responsible for microcirculation or there is some change in the composition of fluid surrounding the lens as well as hair cells of inner ear as both these structures do not have direct blood

supply. The correlation between presbyopia and presbycusis need to be studied further in relation to the above parameters as well as other physiopathological factors affecting the body with advancing age.

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