



## Refractive Errors and Their Impacts on Cervical Spine

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### Abstract

**Purpose:** the study aims to investigate the refractive error and their impact on the cervical spine.

**Methods:** A total of 106 subjects were recruited after satisfying inclusion criteria and informed written consent. The subjects were asked to fill the questionnaire related to neck discomfort and refractory errors by Goggle forms. Based on whether the subjects wear spectacles or not they are divided into Group A subjects wearing spectacles and group B subjects with non-spectacles. Later the subjects were divided on the basis of refractory error into 4 subgroups; group M (Myopia), group H (Hyperopia), Group P (Presbyopia) and Group T (Astigmatism).

**Results:** The mean neck discomfort levels were higher in Group A than Group B and the results showed us that there was a statistically significant difference at  $p < 0.05$ . The neck discomfort levels were higher in Myopia subjects (group M), but the results were not statistically significant.

**Conclusion:** Myopia is the most common refractive error in young adult population .The subjects wearing spectacles have a large impact on neck discomfort in comparison with the subjects not wearing spectacles.

**Key words:** Refractive Error; Neck discomfort; Myopia; Hyperopia.

### 1.Introduction

Cervical pain has a great impact on people's lives, especially seen in young Adults. It is the second most globally affecting disorder associating with spine dysfunctions and affects people of every age group including children as well as adolescents. According to the global burden of disease study (2010), cervical pain is the fourth leading cause of inefficiency (1).

It is observed in previous studies that there is a high prevalence of chronic neck pain in the society.

Studies indicate that 67% of individuals suffer from neck pain at some stage throughout life. The etiology in most of the cases remains unknown but is generally found to be associated with bad postural awareness and habitual postures that leads to larger load on supporting structures (2).

The inability of the eye to correctly focus rays of light from an object on the retinal plane leads to refractive error of the eye.

The refractive errors of the eyes that are found most commonly are Myopia (short or near sightedness), Hyperopia (long or far sightedness), Presbyopia and Astigmatism (irregular curved cornea). Myopia being one of the most common refractive errors of the eye (3).

From the previous researches, it was seen that individuals with myopia usually squint, tilt their heads or lean forwards in an abnormal position to have clear vision. This may eventually lead to common musculoskeletal problems like neck pain, stiffness in the neck, shoulder and back muscles. These problems are ignored by a normal person, and eventually it may lead to more severe complications (4).

The use of new technology requires prolonging visual demand in a restricted visual space. This situation implies a continuous overexertion of accommodation and convergence (5).. This situation leads to an increase in neck discomfort which is influenced by age, gender, occupation and the posture (6)..

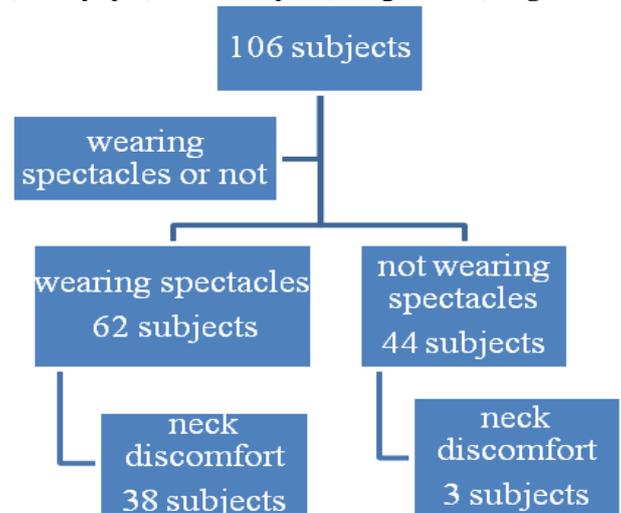
In previous studies it was observed that visual problems are associated with systemic body structural, postural and cognitive dysfunctions which are influenced by time leading to disorganization and diseases. In the same way, any alteration in the body posture, dynamics and structure leads to visual problems (7). From previous researches, it was found that people wearing spectacles have a negative effect on endurance of deep neck flexor muscles (8).. This study is aimed at finding the impact of refractory error on cervical spine. The first objective of the study is to compare and quantify the neck discomfort levels among subjects wearing and not wearing spectacles. The second objective is to compare the neck discomfort levels among subjects with different refractory errors.

## 2. Patients and Methods:

### 2.1. Study participants and recruitment criteria:

This study was conducted at the Department of Ophthalmology in association with the Physiotherapy department of the university hospital. It is a cross-sectional study. A total of 106 patients who satisfied the inclusion criteria were recruited for the study after written informed consent. The inclusion criteria were patients with a confirmed diagnosis of refractive error, both females and males, older than 15 years, conscious, and coherent. Patients with multiple eye disorders like Glaucoma, Cataract and Xerophthalmia were excluded from this study. The subjects wearing spectacles were grouped in Group A (n=62), and those not wearing spectacles in Group B (n=44)

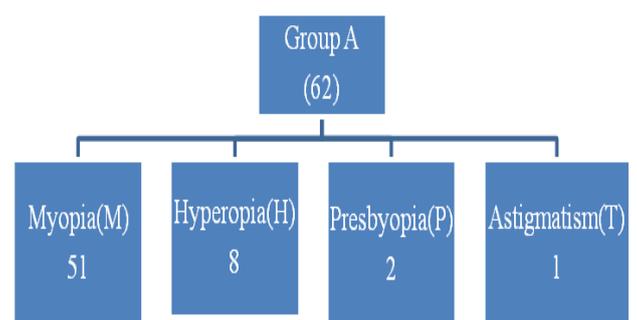
**Figure 1.** The subjects were also classified on the basis of refractive error into 4 subgroups, group M (Myopia), group H (hyperopia), Group P (Presbyopia) and Group T (Astigmatism) **Figure 2.**



**Figure 1: Participation Flow Chart**

### 2.2. Method of data collection:

All the subjects who were enrolled in this study were asked to fill in the questionnaire. Due to the COVID-19 situation, patients were asked to fill it in online through Google forms. The data was recorded and cross-checked telephonically. Clear instructions regarding the study were given along with the link. Patients had to self-record their responses and submit it. For queries, the email address of principal investigator was provided. The questionnaire was composed of demographic data (age, gender and occupation) along with 7 questions to examine the impact of the refractive index on cervical spine. (Table 1).



**Figure 2: Prevalence of refractive error of eye**

### 2.3. Statistical analysis:

The neck discomfort of groups A and B were compared using an unpaired t test for the level of significance  $p < 0.05$ . The levels of neck discomfort in the groups based on refractive error (M,H,) were also analyzed for statistically significant difference by unpaired t test.

**Table (1) : Questions related to refractive errors and neck discomfort**

S.no.	QUESTIONS	RESPONSES			
1	Do you wear spectacle?	Yes (1)		No (2)	
2	Which type of refractive error you have?	Myopia (1)	Hyperopia (2)	Presbyopia (3)	Astigmatism (4)
3	Do you experience discomfort in neck?	Mild (1)	Moderate (2)	Severe (3)	None (0)
4	How many hours you wear spectacles?	0-5hours in a day	6-10 hours in a day	11-15 hours in a day	16-20 hours in a day
5	Do you have other visual impairment?	Yes	No	Not sure	
6	How many hours you use electronic gadgets?	0-5hours in a day	6-10 hours in a day	11-15 hours in a day	16-20 hours in a day
7	What is the most opted position during the use of gadgets?	Lying	Sitting	Standing	Not sure

### 3.RESULTS:

In this study to find the impact of refractory errors on cervical spine, the discomfort levels between Group A and B were analyzed using an unpaired t-test. The mean neck discomfort levels were higher in Group A than Group B and the results showed us that there was a statistically significant difference at  $p < 0.05$  (Table 2).

**Table (2): Comparison of neck discomfort between Group A and B.**

Variables	GROUP A	GROUP B	T value	p significance
No. of subjects	62	44	6.25	$P < 0.05$
Neck discomfort Mean +/- SD	0.98 +/- 0.89	0.09 +/- 0.13		
Percentage of neck discomfort	61.29%	6.8%		

From the data of our study, we found that the most common refractive error in young adults is myopia (Table3).

The neck discomfort levels were higher in Myopia subjects (group M) but the results were not statistically significant (Table4).

However, 71% of Group H subjects reported neck discomfort in comparison with Group M having 58.8 %.

We didn't get enough sample in Presbyopia (n=2) and astigmatism (n=1); hence we didn't analyze for statistical significance.

### 4.DISCUSSION:

In this study, a total of 106 subjects were enrolled of which male subjects were 61 and female subjects were 45. The mean age of the subjects is  $23.3 \pm 3.73$ . The subjects of group A were 62 and group B 44. Out first objective was to find the levels of neck discomfort in subjects wearing spectacles ( group A) versus non-spectacles( group B). The data reveals that neck discomfort is most commonly found in subjects wearing spectacles (Group A) in the young adult population. Tasks involving use of spectacles like reading, writing, white collar job involving computer screens, smart phones, and other gadgets need a certain amount of movement in the neck and adjustments or small compensatory posture , so that the line of focus is perfect and aligned, for a better and clear vision required for the task. Most of these tasks require forward bending of the head on the neck or a chin tucks position, and thus, involves anterior neck muscles.

**Table(3): Prevalence of refractive error of eye.**

Refractive error	MYOPIA(M)	HYPEROPIA(H)	PRESBYOPIA(P)	ASTIGMATISM(T)
Total no. of subjects	51	8	2	1
Percentage	82.2%	12.9%	3.2%	1.6%

The utility of forward head posture does not necessary indicate pain or dysfunction, but it suggests that there is a possibility of developing musculoskeletal problems in the future (4).

**Table (4): Comparison of neck discomfort between Group M and H.**

Variables	GROUP M	GROUP H	t value	p significance
No. of subjects	51	8		
Neck discomfort Mean +/- SD	0.94 +/-0.88	0.75 +/-0.5	0.55	P>0.05

It is also found that sustained contraction of ciliary muscles was related to an increase in activation of trapezius muscle, and that may result in the development of musculoskeletal complaints in the neck area (9).

The second objective of our study is to compare the levels of neck discomfort based on type of refractive error. From our data, we found that there is no statistically significant difference in neck discomfort levels among different refractory error subjects. However, 71% of Hyperopia subjects reported neck discomfort in comparison with myopia. We couldn't statistically analyze presbyopia and astigmatism subjects due to very minimal sample size to avoid statistical errors. We also found that the most common refractory error in young adults is Myopia.

There were researches correlating refractive error with neck discomfort, but no or a few relevant studies were found on the level of neck discomfort in various types of refractive error. Timely identification of the refractive error of the eye and educating the patient about neck discomfort symptoms. Providing a healthy visual working environment will prevent musculoskeletal disorders (6).

## 5.CONCLUSION:

From this study, we conclude that myopia is the most common refractive error in young adult population. The subjects wearing spectacles have a large impact on neck discomfort in comparison with the subjects not wearing spectacles. Thus, refractive error has an impact on the cervical spine. We recommend neck exercise and stretching to improve the cervical mobility and good posture ergonomics to prevent neck discomforts and thereby reducing the impacts of refractive error of the eye on the cervical spine. We also suggest people to address the refractive error with neck discomfort at an early stage in order to avoid and reduce the complications.

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