

## Smoking As a Risk Factor for the Development of Presbyopia: A Cross-Sectional study in Gujarat state in India

Aparna Kekan<sup>1</sup>, Gireesh Mishra<sup>2\*</sup>

<sup>1</sup>Associate Professor, Department of Ophthalmology, Parul Institute of Medical Sciences and Research, Parul University, Vadodara, Gujarat, India

<sup>2</sup>Associate Professor, Department of Ophthalmology, Military Hospital, Jabalpur, Madhya Pradesh, India

Received: 09-06-2021 / Revised: 06-07-2021 / Accepted: 01-09-2021

### Abstract

**Background:** Presbyopia is a natural phenomenon of the aging process of the eye which is physiologically featured by the hardening of the lens and weakening of the ciliary muscles that resulted in the difficulty accommodation for near vision. There are several sociographic factors that facilitate this process and bring this at the early age. **Objective:** This study aimed to determine prevalence of presbyopia in the smokers as compared to normal patients in north Indian cohort. **Methods:** This is a comparative cross-sectional study carried out in between June 2018 and May 2020. Out of 1170 patients visited to ophthalmic out-patient department OPD have grouped into group 1 (n=220, Smoking) and group 2 (n=220, Non-smoking). Optometric and ophthalmologic examinations were performed on all participants. Presbyopic correction coverage were calculated, and the results were analysed. **Results:** Presbyopia was observed earlier in smoking group than non-smoking group. onset of presbyopia in smoker group was significantly higher ( $p < 0.01$ ) in all age class as compared to non-smoker group. Patients wearing glasses for near task were higher among the smoking group within each age class. Significant differences in the age of onset and earlier progression of presbyopia were detected between smoking and non-smoking patients ( $p < 0.01$ ). There was significant correlation between onset of presbyopia and onset of addiction to cigarette ( $P < 0.05$ ). **Conclusion:** Smoking population is more vulnerable for developing presbyopia. In addition, smoking patients catch presbyopia at earlier ages than non-smoking patients. This highlights on controlling smoking habits to avoid future development of eye-related disorders.

**Keywords:** Presbyopia, smoking, group.

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

### Introduction

Presbyopia is an age-related physiological insufficiency of accommodation of the eye that results in gradually worsening ability to focus clearly on close objects. Due to accommodation difficulty reaching from 15D to 1D, symptoms of presbyopia included trouble reading small print, Blurred vision, headaches, eyestrain, asthenopia, fatigue from near work, increased working distance and need for brighter light for reading[1]. Presbyopia was estimated to affect more than 1 billion people globally in 2005, and in 2015, it is estimated to affect 1.8 billion people with high-quality prevalence data were available only for 4 countries, Tanzania, Brazil, Timor-Leste and India[2]. In south India of 5587 subjects 30 years of age or older, the age-, gender-, and area-adjusted prevalence of presbyopia was 55.3%[3]. A higher prevalence of presbyopia was associated with increased age, female gender, higher educational level particularly reading habit, and residence in town[4].

Subject can be considered as presbyopic if they are unable to read the N8 optotype with distance correction in place, if needed and are able to read at least one more line with the addition of a plus lens. The human lenses exhibited a distinct viscoelastic behavior which get lost during the aging.

Physiological reason of presbyopia are the weakening of ciliary muscles and the hardening of lens which is common feature of aging[5].

Like its toxic effects on other body parts, smoking also badly affects eyes and its working. Smoking has been directly linked to two of the leading causes of vision loss, cataracts, and macular degeneration[6]. Very few know the link to vision loss. Research shows that smoking increases the risk of dry eye syndrome, cataracts, Age linked macular degeneration, glaucoma, cataracts, glaucoma and diabetic retinopathy and Dry Eye Syndrome. Many studies have explored the association between smoking and age-related eye disorders and found a causal relationship.

Though India is among the top four countries for presbyopia, very few studies have investigated the role of smoking for the development of presbyopia[3]. Therefore we designed this study with the aim of determining the prevalence of differences in age at onset and progression of presbyopia between smoking and non-smoking patients.

### Materials and methods

This is a comparative cross-sectional study carried out in Parul Sevashram Hospital, Waghodia, Vadodaa, Gujrat, India between June 2018 and May 2020. Patient visited for our Ophthalmology Out-patient Department (OPD) for vision related issues were screened. Total 1170 patients visited to OPD and 690 have complained about difficulty in the near vision. Among them, 550 patients were identified to have presbyopia. In all these patients, daily history with 10 questions was assessed, and they did undergo the near vision testing. Based on smoking habit of these patient, observations after near vision testing and considering the age between 30 and 70 years old, we have grouped 220 patients into group 1 (Smoking) and 220 patients into group 2 (Non-smoking).

The objective of this study was to determine the correlation between the onset of presbyopia and smoking. The minimum age criteria for

\*Correspondence

**Dr. Gireesh Mishra**

Associate Professor, Department of Ophthalmology, Military Hospital, Jabalpur, Madhya Pradesh, India.

E-mail: [gireeshmishra1960@gmail.com](mailto:gireeshmishra1960@gmail.com)

inclusion the study was 30 years and maximum age for the inclusion is set at 70 years. Demographic data including age, gender, and education level were obtained from all participants. In group 1 (Smoking) all were male.

**Assessment of visual testing**

For the identification of the ocular disease or refractive error of the person testing of corrected near visual activity and habitual distance visual activity and enable assess the patient’s ability to function. All the individuals underwent examination of fundus, color vision, visual activity and Snellen visual activity. Snellen visual acuity dimensions were occupied by a standard projected eye chart by means of black letters on a white background. Subjective refraction was carrying out on the right and then the left eye of all entitled subjects, together without and with spectacles. Refraction was executed using retinoscope and a routine objective and the result was utilised as a

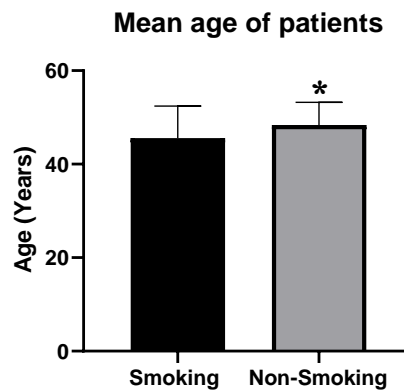
starting point for the succeeding subjective refraction. Data were collected using a designed questionnaire.

**Statistical analysis**

The data collected were analysed using Graph-Pad prism software. Data were expressed in form of proportions and frequency tables for categorical variables. Means and standard deviation were used to summarize continuous variables. The test statistics used included students t-test at  $p < 0.05$ .

**Results**

Smoking people were aged between 30 and 70 years. The mean age of patients in the smoker group is  $45.56 \pm 6.87$  and the mean age of non-smokers was  $48.36 \pm 4.86$  (Figure 1). Onset of presbyopia among non-smoker group was 43 to 70 years and in smoker group this was 33 and 70 years. Table 1 shows the demographic characteristics of the patients from both groups.



**Figure 1: Represents mean age of patients from both smoking and non-smoking groups who develops presbyopia**

Onset of presbyopia across various ages among smoking group was different compared to normal group (Table 2). For each group, we have divided patients into slot such as 30-35, 36-40, 41-45, 46-50, >50 years age group and counted the number of patients with presbyopia in each age group in both the groups and compared this prevalence statistically. In each class, onset of presbyopia in smoker group was significantly higher ( $p < 0.01$ ) in all age class as compared to non-smoker group.

**Table 2. Prevalence of presbyopia among various ages in smoking and normal groups (no=440).**

	Non-smoking (n=220)	Smoking (n=220)	P value
<b>Age</b>	<b>No (%)</b>	<b>No (%)</b>	
30-35	1 (0.5)	4 (2)	
36-40	1 (0.5)	8 (4)	
41-45	3 (1)	93 (42)	<0.01
45-50	13 (6)	42 (19)	
>50	202 (92)	73 (33)	
Total	220 (100)	220 (100)	

Number of patients who use the glasses for near task was also higher among the smoking group within each age class. Twenty-one of smoking group aged 34-42 years were using glasses for near task while nobody reported using glasses in normal group of same age. Eighty-five patients with ages between 43-50 year among smoking group needed to use glasses for near tasks, but nobody in normal group needed presbyopic glasses. Significant differences in the age of onset and earlier progression of presbyopia were detected between smoking and non-smoking patients ( $p < 0.01$ ). This suggests that smoking patients catch presbyopia at earlier ages than non-smoking patients. Onset of addiction to smoking at 10-15 years of age was 15 (7%), 16-20 years 45 (20%), 21-25 years 78 (35%), 26-30 years 54 (25%) and above 30 years 28 (13%) patients (Table 3). There was significant correlation between onset of presbyopia and onset of addiction to cigarette ( $P < 0.05$ ).

**Table 3. Prevalence of onset age of addiction to smoking at different ages**

Age onset of smoke	No (%)
10-15	15 (7)
16-20	45 (20)
21-25	78 (35)
26-30	54 (25)
>30	28 (13)
<b>Total</b>	<b>220 (100)</b>

**Discussion**

Number of evidence showed a strong link between presbyopia with various sociodemographic variables of the population. Amongst,

increased age, female gender, higher educational level particularly reading habit, and residence in town are most common factors associated with presbyopia[4]. In India, a study conducted in the south

Indian cohort suggested that increase in age, female sex, rural residence, myopia, and hyperopia were directly associated with presbyopia. On the other hand, alcohol consumption is found to be inversely associated with presbyopia[6].

In the present study we have studied the role of smoking in the development of presbyopia in north Indian cohort. To the best of our knowledge this is first study of this kind in this geographical region. Tobacco smoking is the debilitating factor for the development of many serious and chronic diseases in human such as heart diseases, lung problems, and cancer. A causal relationship between smoking and age-related eye disorders is also well known. Smoking is also identified as a cause of blindness but that in turn serve as a strong motivating factor to quit smoking.

In the present study we have evaluated differences in age of onset and progression of presbyopia in patient with smoking habits as compared to non-smokers cohort. We recorded that the age of onset of functional presbyopia among smokers was earlier compared to non-smokers. Approximately 50% of the presbyopias cases are observed in the patient below 45 years of age in smoking groups. However, in the non-smoking group, only in 8% of patients' presbyopia was observed who were below the age of 50 years. Like our results, highest incidence of presbyopia is reported among 40 years of age and older[4]. Our observation strongly correlates the smoking habit with the occurrence of presbyopia, and this is like previous report indicating that almost all patients older than 40 years have presbyopia globally[7]. In southern India, a prevalence of 55 percent in subjects aged 30 years and older[3].

More than 25% of the smoking groups initiated to smoke at the age below 20 years. The study showed that the onset and progression of presbyopia among smoking group was earlier than normal group.

Number of physiological consequences are reported with smoking that are plausible reasons for the development of eye-related disorders such as presbyopia. This includes considerable surge in the oxidative stress in the lens, increased blood flow in the ophthalmic arteries and central retinal veins[8]. However, the precise mechanism underlying presbyopia in smokers is not clear.

**Conflict of Interest: Nil**

**Source of support: Nil**

### Conclusion

It is important to note that this type of study has become less frequent, at least in the Asia and in India. Furthermore, it is difficult to compare our study with the other population-based studies as we can not neglect the role of other sociographic factors related to age for the development of presbyopia. This study suggested a strong association between the development of presbyopia and smoking habits as smokers have a higher risk of the more advanced presbyopia.

### References

1. Gary L. Care of the patient with presbyopia. Optometric clinical practice guidelines. 2006; 1:3-5.
2. Fricke TR, Tahhan N, Resnikoff S, Papas E, Burnett A, Ho SM, et al. Global Prevalence of Presbyopia and Vision Impairment from Uncorrected Presbyopia: Systematic Review, Meta-analysis, and Modelling. *Ophthalmology*. 2018;125(10):1492-1499.
3. Nirmalan PK, Krishnaiah S, Shamanna BR, Rao GN and Thomas R. A population-based assessment of presbyopia in the state of Andhra Pradesh, south India: the Andhra Pradesh Eye Disease Study. *Invest Ophthalmol Vis Sci*. 2006; 47:2324-8.
4. Burke AG, Patel I, Munoz B, Kayongoya A, McHiwa W, Schwarzwaldner AW and West SK. Population-based study of presbyopia in rural Tanzania. *Ophthalmology*. 2006; 113:723-7.
5. Weeber HA, Eckert G, Soergel F, Meyer CH, Pechhold W and van der Heijde RG. Dynamic mechanical properties of human lenses. *Exp Eye Res*. 2005; 80:425-34.
6. The health consequences of smoking: a report of the Surgeon General. Atlanta (GA): US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2004.
7. Holden BA, Fricke TR, Ho SM, Wong R, Schlenker G, Cronje S, Burnett A, Papas E, Naidoo KS and Frick KD. Global vision impairment due to uncorrected presbyopia. *Arch Ophthalmol*. 2008; 126:1731-9.
8. Kaiser HJ, Schoetzau A and Flammer J. Blood flow velocity in the extraocular vessels in chronic smokers. *Br J Ophthalmol*. 1997; 81:133-5.