

**ORIGINAL RESEARCH**

# The effect of durative computer usage on Intraocular pressure

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**ABSTRACT**

**Aim:** To investigate the changes in the Intraocular pressure (IOP) in adults on prolonged computer usage. **Methods:** 31 adult subjects working with computers for prolonged hours had their Intraocular pressure checked with Schiotz tonometer. Measurements were taken initially on every individual before computer usage and then following 3 hours of computer usage. **Results:** There was significant rise in the Intraocular pressure (Mean Increase of Intraocular pressure is 1.23mm of Hg) in most of the myopic subjects after 3 hours of continuous usage of computer. **Conclusions:** Prolonged computer usage could induce transient Intraocular pressure elevation. Mostly Intraocular pressure elevation is seen in myopic subjects whereas emmetropic subjects showed little or no elevation.

**Keywords:** IOP, Intraocular Pressure, accommodation, near work, computer.

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**INTRODUCTION**

It is widely accepted fact that near work is an important factor in development and progression of Myopia. The change in Intraocular pressure with durative near work / computer usage is still in question. Durative near work and computer usage has been greatly increased in these times. From the age of 2 children are using Mobile phone, tablets etc., This could effect on their axial length of their eyeballs and cause myopia in future. Tomlinson and Phillips reported for the first time that the mean Intraocular pressure value of myopes was (15.49± 2.85 mm of Hg) significantly higher than that of emmetropes (14.74±2.28 mm of Hg)<sup>1</sup>. They also found that Intraocular pressure was related positively to axial length and refractive power of the eye. Regarding the pressure changes there are two school of thoughts on Intraocular pressure change during accommodation. Previous studies utilizing applanation tonometers have noted a reduction in Intraocular pressure to occur with accommodation.<sup>2,3</sup> Few other studies demonstrates increased Intraocular pressure during accommodation in primates.<sup>4,5</sup> Our study aimed at exploring Intraocular pressure change in a group of patients who work on computers as a part of their main job, who work on computers for prolonged hours. We have examined the

influence of computer usage on Intraocular pressure using Schiotz tonometer.

**MATERIAL AND METHOS**

**Subjects:** Thirty-two software employees participated in this study. Every individual had undergone a general eye examination to ensure no eye pathology. Six of the thirty-two subjects were female. No one reported any history of eye diseases, trauma or surgery. No one is on any medication that might have affected their Intraocular pressure or accommodation. No one reported any history of contact lens wearing in the last month prior to the day of examination.

**Inclusion Criteria:** Individuals who constantly work on computers. Individuals who has the best corrected visual acuity of 6/6 in both eyes. Individuals who don't have the history of Glaucoma.

**Exclusion Criteria:** Individuals who don't constantly work on computers. Individuals with any pathology of eye. Individuals without BCVA of 6/6. Individuals with history of Glaucoma. Individuals on any topical medications of eye. Individuals with hypertension or on

anti-hypertensive medication. Individuals with history of any eye surgery.

**Procedures:** Every individual had BCVA of 6/6. The experiment protocol was described as following: first Intraocular pressure of both eyes will be measured for every individual before starting their computer usage. Then everyone is advised to start their work and continue working for 3 hours. Baseline Intraocular pressure was measured after 10 minutes of viewing a distant target. Then each individual is tested for Intraocular pressure as earlier. The measurements were repeated by same instrument and doctor. Every measurement was repeated 3 times to ensure instrumental error/ subjective error/ objective error while recoding. The measurements were taken in supine position with eye fixed at distant object.

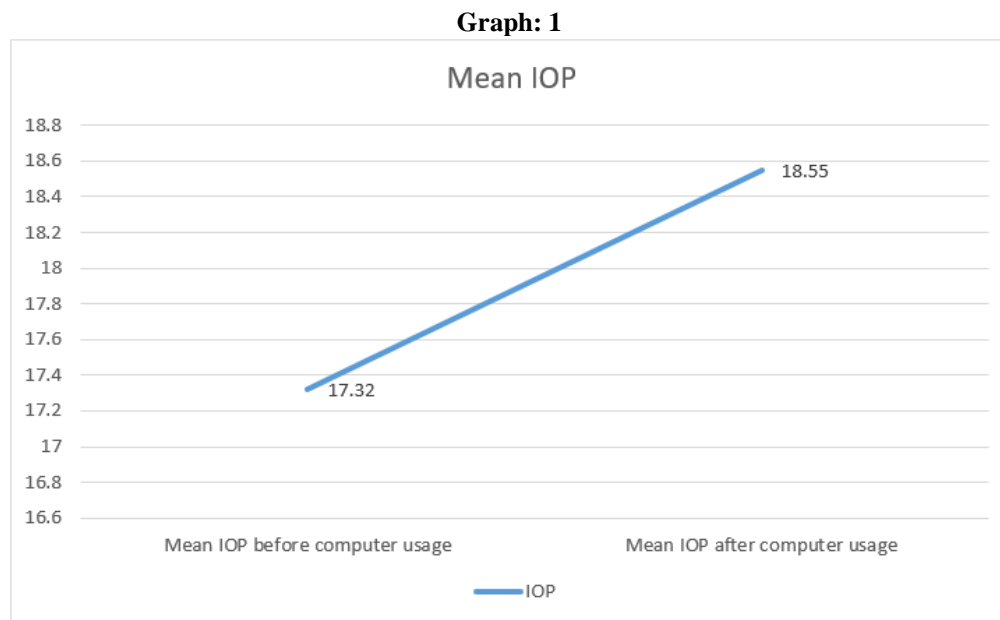
**Statement of Ethics:** We certify that all ethical rules were followed with the volunteers during the research.

**Physiology of Intraocular pressure change during accommodation:** Intraocular pressure is predominantly controlled by aqueous outflow. Aqueous humor entering the anterior chamber is drained through the trabecular meshwork, into Schlemm canal, the collector channels, and scleral veins. The drainage of aqueous humor through the trabecular meshwork route is a passive process due to the pressure difference between the intraocular pressure and the episcleral venous pressure. Recently, however, it has been said that the aqueous outflow system acts as a mechanical pump that controls both pressure and flow which is controversial to earlier data.<sup>7</sup>Ocular pulse, blinking, and eye

movements, microscopic deformation of the trabecular meshwork and Schlemm canal produce transient pressure spikes which is supposed to produce pulsatile unidirectional drainage of aqueous humor into the vascular system.<sup>7</sup>Aqueous outflow is increased by widening of pores of trabecular meshwork by traction scleral spur. This traction is done by the ciliary muscles contraction induced by accommodation. Theoretically, frequent and repeated ciliary muscle contractions can also affect the elastic tissue structures of the chamber angle and induce a similar pulsating flow of aqueous humor. Zonular tension also increases the sclera spur traction. If the tension on sclera spur decreases, aqueous outflow decreases and Intraocular pressure will be raised. The relation of decrease in pore size and raise in Intraocular pressure is hyperbolic curve. A decrease in pore size from 1.50 to 1.25 microns of pore diameter increases the Intraocular pressure by 2mm of Hg.<sup>8</sup>Whereas decrease in pore diameter from 1.00 microns to 0.75 microns increase the Intraocular pressure by 10mm of Hg.<sup>8</sup>Increasing intraocular pressure (Intraocular pressure) produces progressive collapse of the Schlemm canal.<sup>9</sup>During constant near work on accommodative spasm may occur which decreases tension on scleral spur and the diameter of the pores of trabecular meshwork decreases resulting in raised Intraocular pressure.

## RESULTS

In our study we found that there has been a significant rise in intraocular pressure after constant 3 hour of computer usage with mean increment of 1.23 mm of Hg.



**Graph 1: Mean Intraocular pressure of the subjects before and after 3-hour computer usage.**

**Table: 1** Pre and post computer usage recorded intraocular pressure data of both eyes of 31 subjects.

S No	Age	Sex	OD - Intraocular pressure before computer usage	OD - Intraocular pressure after computer usage	Difference in pressure OD	OS - Intraocular pressure before computer usage	OS - Intraocular pressure after computer usage	Difference in pressure OS
1	36	M	18.6	17.3	-1.3	20.6	18.8	-1.8
2	38	M	17.3	18.9	1.6	15.9	17.3	1.4
3	33	M	17.3	17.3	0	17.3	17.3	0
4	27	M	14.6	17.3	2.7	14.6	18.9	4.3
5	29	M	11.2	18.9	7.7	11.2	18.9	7.7
6	27	M	12.2	15.9	3.7	12.2	14.6	2.4
7	36	M	17.3	17.3	0	17.3	17.3	0
8	34	F	15.6	18.9	3.3	15.6	18.9	3.3
9	28	M	18.9	18.9	0	18.9	17.3	-1.6
10	28	M	13.4	15.3	1.9	13.4	14.6	1.2
11	25	M	17.3	17.3	0	17.3	14.6	-2.7
12	36	M	14.6	15.9	1.3	14.6	18.9	4.3
13	25	F	17.3	17.3	0	17.3	18.9	1.6
14	27	M	18.9	18.9	0	18.9	18.9	0
15	24	F	20.6	20.6	0	20.6	22.4	1.8
16	30	M	21.9	22.4	0.5	25.8	26.6	0.8
17	25	F	13.4	14.6	1.2	14.6	14.6	0
18	24	M	17.3	20.6	3.3	15.9	17.3	1.4
19	31	M	18.5	20.6	2.1	23.8	22.4	-1.4
20	30	M	15.9	15.9	0	15.9	15.9	0
21	31	M	14.6	17.3	2.7	15.9	17.3	1.4
22	35	M	18.9	18.9	0	22.4	24.4	2
23	34	M	15.9	17.3	1.4	15.9	15.9	0
24	33	M	17.3	17.3	0	15.9	17.3	1.4
25	42	M	22.4	20.6	-1.8	18.9	20.6	1.7
26	32	M	15.9	18.9	3	17.3	18.9	1.6
27	27	F	21.9	20.6	-1.3	25.8	25.8	0
28	38	M	20.1	20.6	0.5	20.1	20.6	0.5
29	23	F	14.6	15.9	1.3	15.9	18.9	3
30	30	M	17.3	18.9	1.6	17.3	20.6	3.3
31	26	M	18.9	18.9	0	17.3	20.6	3.3

## DISCUSSION

Our study found that there is a significant rise in Intraocular pressure in most of the myopic subjects after prolonged usage of computer. Our results were congruous with Young's study<sup>4</sup> in 1975 and L Yan *et al.* study<sup>5</sup> in 2014, which demonstrated Intraocular pressure rose during accommodation. Young also calculated that the maximal increase in Intraocular pressure could reach 6mm of Hg during accommodation. L Yan *et al.* have found that the Intraocular pressure experienced a transient elevation in progressing myopes and decreased a little in emmetropes when accommodation was induced. On the other hand, there are many other studies like Robert R

Mauger *et al.*<sup>3</sup> which shows that Intraocular pressure might decrease with accommodation because of the opening of Schlemm's canal due to ciliary muscle contraction, which exerts stress on the trabecular meshwork. But in his study Intraocular pressure was measured after 3 min and 6 min of fixating of a distant target. They didn't work up on cases of prolonged accommodation. The other study which showed decrease in Intraocular pressure on accommodation is Scott A Read *et al.*<sup>6</sup>. But this group also measured Intraocular pressure after 7 min of accommodation rest followed by 2 min of accommodation. The 2 studies which showed Intraocular pressure decrease on accommodation were only the immediate effects of

Intraocular pressure on accommodation. But neither showed the effect of prolonged accommodation on Intraocular pressure. Moreover, we have noticed that all these studies were experimental and induced accommodation artificially using lenses or drugs. However, we on the other hand focused on real life situations where accommodation is induced naturally due to constant and routine computer usage in software employees who are the major group of young people constantly working on computers.

#### LIMITATIONS

- We used Schiottz tonometer instead of standard Applanation tonometer because readings were recorded on site.
- We didn't measure corneal thickness, anterior chamber depth, lens thickness.
- We didn't have control group in our study.
- We didn't measure Intraocular pressure after 8 hours of computer usage which was their regular time of our subjects' computer usage.

#### CONCLUSION

- Prolonged computer usage could induce transient Intraocular pressure elevation.
- Intraocular pressure elevation is seen in myopic subjects whereas emmetropic subjects showed little or no elevation.
- Intraocular pressure elevation can be due to accommodative spasm after prolonged and constant near work.
- Intraocular pressure elevation can be due to increased lens thickness which narrows the anterior chamber depth during accommodation.
- Our study was aimed at Intraocular pressure changes in real life situations by inducing accommodation naturally by subjects' line of work.

- Our further study plans are
  - To record Intraocular pressure using Perkins or digital tonometer.
  - To measure central corneal thickness,
  - To measure peripheral anterior chamber depth and lens thickness before and after computer usage.
  - To compare data with the control group.

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