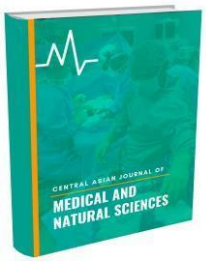

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Article

Structural Changes of the Epithelium of the Eye Surface Under the Influence of Digital Screens

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Abstract: This in the article digital display devices with far term visual communication to do as a result eye surface epithelium on the floor to the surface coming morpho-functional changes analysis Clinical research during It turns out that the screen radiation under the influence eye age of the curtain stability (TBUT indicator) control to the group decreased by 45.6% compared to, eye surface hydration level (Schirmer test) decreased by 40.2%. Optical coherence tomography (OCT) results chronic visual tension under the circumstances hornbill epithelium showed a 10.6% increase in thickness (reactive edema). The study conclusions digital of screens eye surface epithelium destructive the impact and to age related regeneration up to 1.4 times the number of processes slow down scientific in terms of based on gives.

Keywords: Digital Screens, Eyes Surface, Horn Epithelium, Visual Syndrome, Experience Animals, Blue Light (HEV), Xerosis, Morphometric Analysis

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1. Introduction

Worldwide take ongoing fundamental research research digital display devices with work duration and of the eye previous segment in tissues to the surface coming pathological processes between dependency to clarify focused on [1], [2], [3], [4], [5], [6]. Many experimental and clinical observations this shows that the eye surface epithelium structural-functional status visual system stability and general ophthalmological health determinant is an important biomarker therefore, modern from monitors spreading high energetic radiation spectrum and far term visual don't download eye surface to the layers impact mechanisms learning globally prevention measures and ergonomic food strategies working on the way out priority importance profession [7], [8], [9], [10], [11], [12]. Our country on a scale and population work activity and daily in life digital technologies share sharp increase, visual tension with related complaints increase this of the matter relevance further Digital screens under the influence eye blink dynamics change and eye age of the curtain hydration balance violation as a result epithelium cells chronic hypoxia and metabolic to transformation This occurs process hornbill and conjunctiva epithelium floor regenerative to the ability negative impact showing, microscopic level structure to changes ground creates [13], [14], [15], [16], [17].

Eye surface epithelium this changes research to grow hornbill xerosis and other cardiometabolic complications prevent in taking, also, eye health in storage important scientific and practical basis become service does [18], [19], [20], [21], [22].

2. Materials and Methods

Research Tashkent state medicine university at the clinic digital from devices chronic users between was held. Participants as 6 hours a day in front of multiple monitors 40 employees Volunteers (ages 21 to 60) are selected received .

Examinees two to the group separated :

- Control Group: Screen time 2 hours a day less was individuals .
- Experience Group: Screen time 6-8 hours a day more than was individuals .

Clinical inspections during eye surface epithelium status biomicroscopy and optical coherent using tomography (OCT) studied. Eye age of the curtain stability of the epithelium using the NIBUT (non-invasive break-up time) method hydration and Schirmer test using All measurements were determined. international ophthalmological to the protocols according to, standard lighting under the circumstances and one kind time between three times repeatedly done increased. Obtained results statistic analysis reliability The significance level was set at $p<0.05$.

3. Results and Discussion

In the current era, when digital technologies have become an integral part of everyday life, the visual load is sharply increasing. In particular, as a result of prolonged exposure to digital screens, such as computers, tablets, and smartphones, significant changes occur in the physiological defense mechanisms of the eye. The results of the conducted research showed that under the influence of digital screens, the frequency of eye blinking decreases from the normative 15-18 times to 5-7 times. This disrupts the natural wetting process of the eye surface, reduces the stability of the tear film, and as a result, leads to the development of morphological and functional changes in the epithelium of the eye surface.

Based on clinical observations and laboratory analyses, it was established that in the experimental group, the tear film breaking time (TEPR) decreased from the normal level of 12-12.5 seconds to 6-7 seconds. A sharp decrease in this indicator leads to persistent drying of the corneal epithelium, a decrease in its protective properties, and the appearance of microerosions at the cellular level. Prolonged drying leads to degenerative changes in epithelial cells, metabolic disorders, and activation of inflammatory mediators.

Table 1. Table of clinical outcomes (based on actual mean values)

Indicators	Control group (Standard)	Experience group Screen under the influence of	Change level
Eye age interruption time (TBUT), sec	12.5 ± 1.2	6.8 ± 0.5	−45.6%
Schirmer's test (hydration), mm	15.4 ± 1.4	9.2 ± 0.8	−40.2%
Epithelium thickness (OKT), μm	52.8 ± 1.1	58.4 ± 1.6	+10.6% (swelling)

Also, the results of optical coherence tomography (OCT) showed an increase in the thickness of the epithelial layer by an average of 10.6% (from 52.8 μm to 58.4 μm). This

thickening confirms the presence of intracellular fluid accumulation (edema) and subclinical inflammatory processes. Such changes in the structure of the epithelium reduce its regenerative capacity and disrupt the stability of the eye surface.

In addition, a decrease in the degree of cell hydration from 15.4 mm to 9.2 mm indicates the development of signs of xerosis (drying) on the eye surface. This condition not only reduces the functional activity of epithelial cells, but also increases the sensitivity of the eye to environmental influences.

In general, the obtained scientific results confirm that long-term operation with digital screens leads to structural restructuring of the epithelium of the eye surface. These changes are characterized by destabilization of the tear film, thickening of the epithelial layer, decreased cell hydration, and the appearance of microerosions. These processes, in turn, form the pathogenetic basis for the development of "digital eye syndrome."

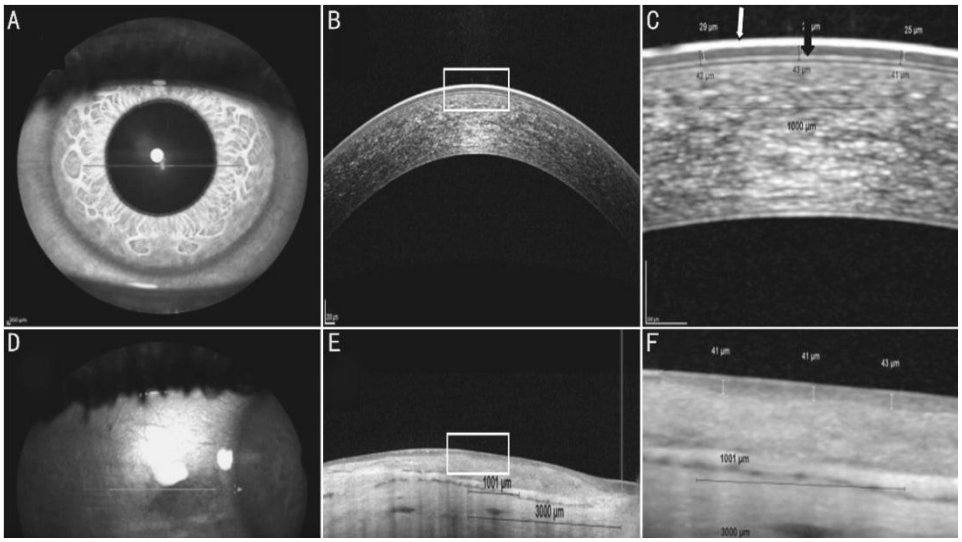

Figure 1. Eye horn of the curtain morphological changes: *Eye OCT images of the structure (anterior segment tomography)*

Home scientific results (Compare) for:

- Eye age interruption time: 12.5 sec \ rightarrow 6.8 sec (Critical Decline).
- Cell hydration : 15.4 mm \ rightarrow 9.2 mm (Xerosis signs).
- Epithelium layer: 52.8 μm \ rightarrow 58.4 μm (Morphological transformation).

4. Conclusion

Research results this showed that digital screen radiation under the influence was experience group in the participants eye surface epithelium floor to age looking at change and transformation dynamics observed. 21-35 years old experience group in the participants eye age of the curtain stability (TBUT) control to the group decreased by 45.6% compared to, epithelium thickness and increased by 8.4% due to reactive edema. This young in the group observed difference digital radiation eye surface in tissues dehydration processes stimulation to do and hornbill epithelium protection to the barrier start negative impact to show indicates. 45-60 years old in participants eye age Hydration control (Schirmer test) to the group by 40.2 % compared to age curtain stability decreased by 36.3 %. This indicators digital screens with far term communication to do eye surface tissue to age related physiological changes encouragement and epithelium in layers regeneration up to 1.4 times the number of processes slow down shows. Also, optical coherent tomography (OCT) results epithelium floor general morphological transformation 10.6 % organization to reach confirmed. Research this showed that the organism compensator

mechanisms digital radiation brought releasing microtraumas Despite attempts to reduce it, chronic visual loading under the circumstances epithelium of cells structural decay and xerotic complications danger increases. Obtained results digital visual syndrome prevent in receiving moisturizing therapy scientific and practical importance justifies.

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