No.10

The Influence of Smartphone Use on the Status of the Tear Film and Ocular Surface

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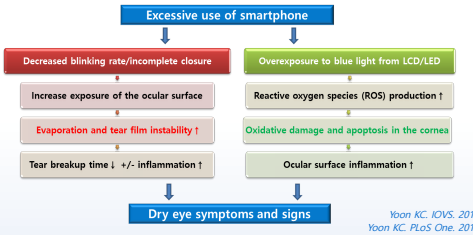
Background

❖ **Smartphone use can affect human health and life**

- Average daily use time: 98 min (2011) → 195 min (2013)
- Sleep disorder, headache, musculoskeletal symptoms, malignant melanoma, brain tumors and leukemia...
- Transient monocular vision loss (2016)
- Acute acquired comitant esotropia in adolescents (2016)

❖ **Ocular symptoms associated with smartphone use**

- Rate and mean time of smartphone use in children (2016)
  : dry eye group >> >non-dry eye group
- May be similar to computer vision syndrome in VDT use?



Yoon KC. IOVS. 2014
Yoon KC. PLoS One. 2016

Purpose

❖ **To firstly investigate the influences of smartphone use on subjective ocular asthenopia, status of the tear film, and levels of inflam. cytokines and oxidative markers in healthy subjects.**

Methods

Subjects and examination

❖ **Subjects**

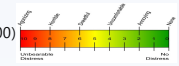
- Fifty young healthy volunteers
- No ocular diseases, systemic diseases, or surgical history

❖ **Examination**

- Smartphone (Galaxy S, Samsung, Korea)
- Fixed brightness, distance, and angle

Evaluation

❖ **Subjective visual asthenopia**



- Ocular surface disease index (OSDI, 0-100)
- Visual analogue scale (VAS, 0-10 mm)
- Computer vision syndrome (CVS) score (0-6, total score : 30)
  - Fatigue, burning, dryness, blurred vision, dullness

❖ **Assessment of the tear film and ocular surface**

- Fluorescein breakup time (FBUT)
- Schirmer test
- Keratoepitheliopathy (KEP)
- Keratograph 5M (Oculus, Germany)
  - Non-invasive BUT (NI-BUT)
  - Tear meniscus height (TMH)

❖ **Samples**

- Basal tear collection using glass capillary tubes or micropipettes
- Lower nasal conjunctiva using impression cytology

❖ **Measurement of inflammatory cytokines**

- Tear sampling
- Magnetic bead-based immunoassay
- Markers: IL-1β, IL-6, TNF-α, and IFN-γ

❖ **Measurement of oxidative stress markers**

- Tear sampling
- Enzyme-linked immunosorbent assay
- Markers: Hexanoyl-lysine (HEL), Malondialdehyde (MDA), 4-hydroxy-2-nonenal (4-HNE), and 8-hydroxy-2′-deoxyguanosine (8-OHdG)

❖ **Measurement of cellular ROS production**

- Conjunctival Impression cytology
- 2′,7′-dichlorodihydrofluorescein diacetate (DCF-DA) assay

❖ **Statistical analysis**

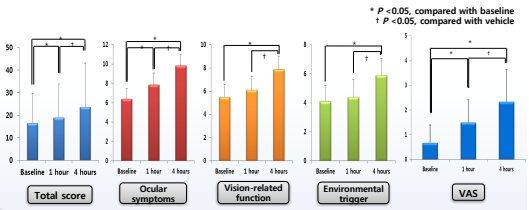
- SPSS ver. 18.0
- Repeated-measures ANOVA with post-hoc test
  - Paired T-test

Results

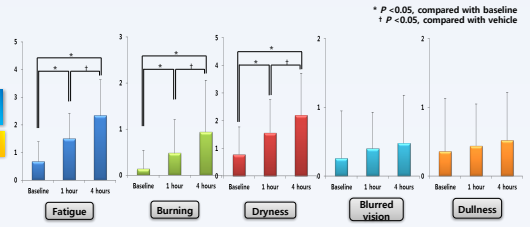
Characteristics	Healthy subjects (N=50)
Age (years)	25.52 ± 2.89
Gender (male/female)	33/17
FBUT (sec)	10.76 ± 2.03
Schirmer I test (mm)	13.66 ± 4.10
KEP (0-9)	0.26 ± 0.56
OSDI score (0-100)	16.43 ± 13.26
Refraction (spherical equivalent)	-2.91 ± 1.30

OSDI scores

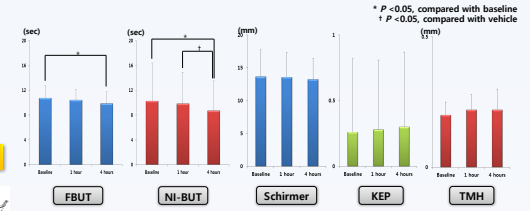
VAS score



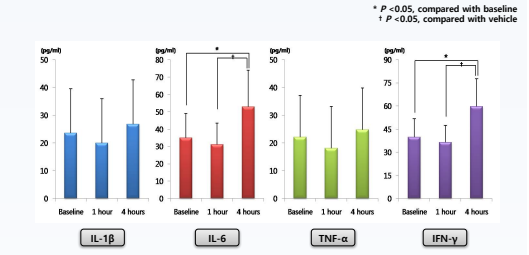
CVS scores



Status of the tear film

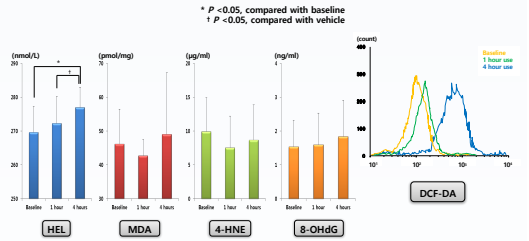


Level of inflammatory cytokines



Level of oxidation markers

ROS production



Conclusions

❖ **Smartphone use could not only aggravate subjective symptom indices but also induce tear film instability, oxidative stress, and inflammatory response in the tears and ocular surface.**

In relation to this presentation, I declare that there are no conflicts of interest(kcyoon@jnu.ac.kr)