A pair of diopter-adjustable eyeglasses for presbyopia correction

Lihui Wang*, a, Alvaro Cassinelli a, Hiromasa Oku b, and Masatoshi Ishikawa a

a The University of Tokyo, Japan, b Gunma University, Japan

Summary

We describe and demonstrate a pair of diopter-adjustable eyeglasses aimed to correct presbyopia; the glasses provide a tunable optical power in the whole surface of the lens cell, eliminating the optical distortion typical of bifocal/trifocal or progressive glasses. The wearer can actively control the optical power by a simple sliding gesture on the bridge of the glasses, so that presbyopic vision can be interactively corrected.

A natural of our life: Presbyopia

- Noticeable after 40-year-old \( \rightarrow \) plus 0.07 Diopter every year \( \rightarrow \) close to a stable presbyopia diopter after 60.
- Presbyopia differs from myopia and hyperopia, that losing accommodation ability of eye. (crystalline elasticity and the ciliary muscle)

Prevalence and incidence

- China has an increase population of 7 million per year, and this aging population will reach 0.4 billion by 2050.
- By 2060 more than 40% of the Japan's population will be over the age of 65, which means half of the population will be presbyopic.
- The International Centre for Eyecare Education predicted that the worldwide prevalence of presbyopia will increase to 1.4 billion people from the total of 7.7 billion by 2020, and to 1.8 billion people of the whole population of 9.6 billion by 2050.

Treatments and motivation

- Regain the accommodation ability for presbyopic vision by utilizing the variable focus lens.

Proof-of-principle experiment

- A prototype: presbyopia eyeglasses set, driving mechanism, interactive interface
- A camera resembled the prebyopic view, that only the far object was in focus.

Preliminary results

- Three snapshots from a video recording
- With the help of the adjustable eyeglasses, objects were gradually brought to focus.
- Lens aperture size was 26 mm, and no technical challenge in making a larger one.
- Vision was clear without noticeable distortion.
- Tunable diopter range covers presbyopia needs.

Aspect in the future

- In the short term, the miniaturization of the device as a wearable size is the first step.
- User can rapidly change the optical power by any simple gestures, such as squinting gesture, detecting the gazing direction, etc.

References