

**Background and Objective(s):**

Keratoplasty, also known as corneal transplantation, is a surgical procedure in which a damaged or diseased cornea is replaced entirely (penetrating keratoplasty) or partially (lamellar keratoplasty) by a donated corneal graft. Post-keratoplasty astigmatism is multifactorial in its etiology, in which the preoperative factors involve the age and health of donor tissue, recipient pathology, the intraoperative factors include trephine quality, graft size, wound apposition and suturing technique and suture material and the postoperative factors cover wound healing, postoperative drugs, inflammation, corneal vascularization, rejection.

The contrast sensitivity function (CSF) provides a comprehensive measure of the visual system which has been used to characterize spatial vision deficits in many visual disorders such as amblyopia, multiple sclerosis, glaucoma, retinitis pigmentosa, as well as autism spectrum disorder. Although some studies have reported the contrast sensitivity function of keratoplasty patients, few has documented the CSF in different spatial frequencies as well as its relationship between the life quality. To our knowledge, the current study would be the first case series to inquiry the contrast sensitivity function in the keratoplasty patients with quick CSF, as well the relationship between visual quality and life quality.

**Design:**

All participants would undergo an ophthalmic examination that included slit-lamp biomicroscopy , visual acuity, corneal topography, contrast sensitivity measurements, 9-SF life quality questionnaire and fundus examination. Then the normal group would be covered by positive spherical lens of 1.0D to 6.0D to repress the BCVA to 0.1 to 0.9 respectively to compare the visual functions with the keratoplasty patients on the same visual acuity.

**Methods:***Subjects and Inclusion Criteria*

This observational, cross-sectional, non-consecutive case study would be conducted with patients who have accepted keratoplasty and healthy subjects who visited the Corneal Clinic of Zhongshan Ophthalmic Center, Guangzhou, China. The research was performed according to the tenets of the Declaration of Helsinki. The study protocol was approved by the Zhongshan Ophthalmic Ethical Committee. All subjects provided informed consent after receiving both written and verbal explanations of the nature and intent of the study.

The Inclusion Criteria for keratoplasty patients are: 1) Accept the corneal transplantation based on the clinical diagnosis of ocular surface disease; 2) more than 7 and less than 60 years old; 3) absence of other ocular disorders and no history of eye surgery and other systemic diseases. And the exclusion Criteria are: 1) less than 7 or more than 60 years old; 2) with the history of eye surgery and other systemic diseases.

All participants underwent an ophthalmic examination that included slit-lamp biomicroscopy , visual acuity, corneal topography, contrast sensitivity measurements, 9-SF life quality questionnaire and fundus examination. Then the normal group would be covered by positive spherical lens of 1.0D to 6.0D to repress the BCVA to 0.1 to 0.9 respectively to compare the visual functions with the keratoplasty patients on the same visual acuity.

#### *CSF Measurements*

The quick CSF method, implemented in a 10 alternative forced-choice digit identification task, was used to assess the contrast sensitivity function<sup>34, 38</sup>. Stimuli were displayed on a gamma-corrected 46 inch LCD monitor (Model: NEC LCD P463) with a 1920×1080 pixel resolution, 50 cd/m<sup>2</sup> mean luminance and 60 Hz vertical refresh rate. Observers viewed the display monocularly from a distance of 4 m in a dark room. For each trial, they were asked to verbally report the identities of three digits presented on the screen to the experimenter, who used the computer keyboard to enter their responses. The stimuli disappeared after all the responses were entered. Observers were given the option to report “I don’t know” upon which the response

was coded as incorrect. No feedback was provided. All three responses were used to update the posterior distribution of the CSF parameters, which in turn was used to adaptively choose the most informative combination of spatial frequency and contrast for the next trial. A new trial started 500 ms after the responses. There were 30 trials in approximately 5 min. The quick CSF data were scored to generate the cutoff spatial frequency, defined as the spatial frequency corresponding to a perceptual sensitivity of 1, and the area under the log CSF (AULCSF), a summary measure of the window to spatial vision.

### **Statistical Analysis Plan:**

Data would present as means  $\pm$  standard deviations. Between group t-test would be used for statistical comparisons of the CSF results, including cutoff SF and AULCSF between the astigmatism group and the control group. A multiple linear regression analysis would be performed to investigate the relation between the AULCSF and the lens power of astigmatism. Statistical analyses were performed using SPSS version 17.0 (SPSS, Inc., Chicago, IL, USA), and p values of  $< 0.05$  would be considered statistically significant.