

# CONTRAST SENSITIVITY LOSS IN THE ELDERLY

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## Abstract

**Background:** Contrast sensitivity declines as a function of age. This review seeks to delineate the causes of contrast sensitivity loss in the aging population by examining decreases in CSF due to media opacifications and other physiological aging changes occurring within the visual system.

**Methods:** This research was conducted through the review of peer-reviewed journal articles.

**Results and Conclusions:** Literature suggests that contrast sensitivity reductions in the elderly populations is a multifactorial phenomenon, and can be attributed to several factors including optical, neural and physiological aging changes in the eye and visual system.

## Introduction

Contrast sensitivity is a measure of the amount of contrast between a pattern and its background that must exist for visual detection.

A decline in one's contrast sensitivity can compromise spatial awareness and mobility placing patients at an increased risk for accidents and decreases their overall satisfaction with their vision (Rosenthal, 2007).

Loss of contrast is associated with ocular pathological conditions such as cataracts, glaucoma, diabetes and macular degeneration, many of which are more prevalent in the older population. Additionally, physiological age-related changes, e.g. pupillary miosis, also contribute to this loss.

Furthermore, factors not directly related to physiological aging changes, e.g. the efficiency of photon absorption by cones may also lead to reductions in CSF.

## Methodology

The research question was investigated through the review of peer-reviewed research articles written on this topic area. The articles were obtained through access to PubMed and other online biomedical and health science databases.

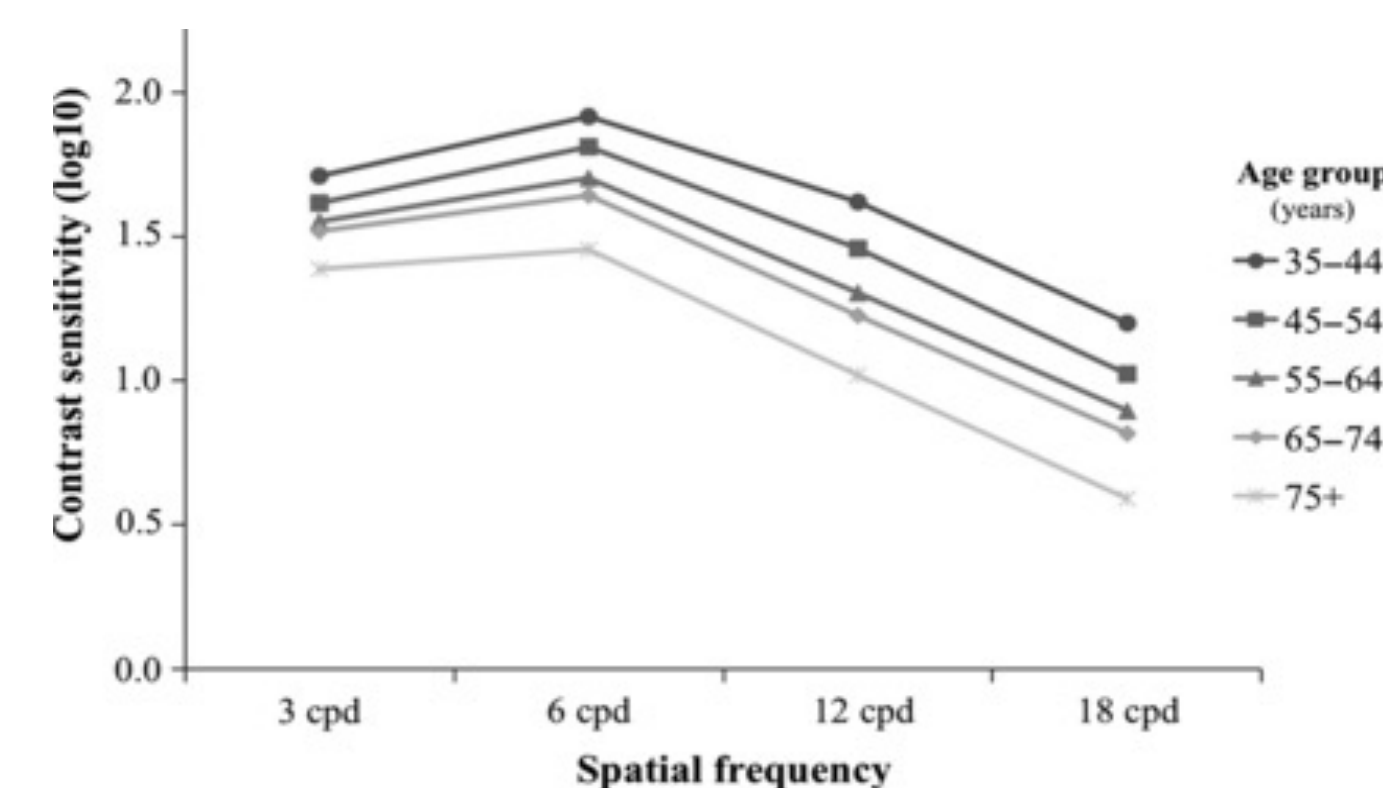
## Results

Contrast sensitivity significantly deteriorates with advancing cataracts. This is apparent using the grading system termed lens opacities classification system (LOCS) III. A stronger correlation was found between the contrast sensitivity function and LOCS III grading score than between the LOCS III and LogMAR VA (Cheng, 2013). While standard visual acuity tests typically measure the high spatial frequency cut-off, the CSF provides evidence that contrast sensitivity decreased along the entire spectrum of spatial frequencies with greater magnitudes of age-related cataracts.

Aging leads to changes within the macula and a study by Subhi et al. systematically reviewed 49 studies containing 9115 participants and 11,577 eyes with the purpose of providing an overview on how macular thickness and volume change with age. They found that aging is associated with a decrease in the inner and outer macular thickness as well as and the overall macular volume (Subhi, 2016). They concluded that contrast sensitivity losses in the older population specifically under photopic and mesopic conditions, was most likely due to thinning of the inner retinal layer in the macular region from ganglion cell loss.

Garcia et al. evaluated the effect of posterior vitreous detachment (PVD) on the contrast sensitivity function. At study entry there was no significant difference in CSF of eyes that were part of the control group and eyes that subsequently developed PVD; however, following PVD there was a 52.5% reduction in CSF. Their conclusions were that a PVD is associated with significant reduction in CSF of previously normal eyes (Garcia, 2016).

Further studies evaluated BCVA and contrast sensitivity pre-op and post-op for Pars plana Vitrectomy following PVD. Mean BCVA improved 13.5% postoperatively ( $P < 0.00001$ ) and CSF improved 53% ( $P < 0.00001$ ) (Rastami, 2019). Their results showed that aging changes within the vitreous can be directly accountable for a decreased CSF of 53% that is reversible when removed surgically.



Sia, D.I.T., Martin, S., Witt ert, G. and Casson, R.J. (2013). Age-related change in contrast sensitivity among Australian male adults: Florey Adult Male Ageing Study. *Acta Ophthalmologica*, 91, 312-317. <https://doi.org/10.1111/j.1755-3768.2011.02379.x>

## Conclusions

Decreasing contrast sensitivity with age is clearly a multifactorial process. Furthermore, the loss of contrast with age seems to be due to a decrease in the photon absorption by the retina which can be attributed to several age-related factors including but not limited to media opacities, density changes in a denaturing vitreous humor, and loss of neural volume with retinal thinning.

The effects of some of these changes can be partially or completely resolved. For example, crystalline lens opacities can be corrected with cataract surgery. Pars plana vitrectomy can be considered if a patient has significant vision degrading myodesopsia. However, loss of CSF due to retinal thinning that occurs with age has no treatment or known preventative measure at this time.

In conclusion, a review of the literature suggests that contrast sensitivity reductions in the elderly populations is a multifactorial phenomenon, and can be attributed to several factors including optical, neural and physiological aging changes in the eye and visual system.

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