CONTRAST SENSITIVITY FUNCTION

AUTHOR

Luigi Bilotto: Brien Holden Vision Institute

PEER REVIEWER

Benoit Tousignant: Université de Montréal, School of Optometry

INTRODUCTION

This chapter includes a review of:

- Contrast sensitivity function (CSF)

CONTRAST SENSITIVITY FUNCTION (CSF)

CSF is usually performed when the integrity of the visual pathway is questionable or when media opacity is present. CSF tests the patient's ability to differentiate between a light and dark stimulus by assessing the perception of black on white. The test stimulus is usually **an alternating light and dark stripe pattern**. A number of CSF analyzers are available: the Arden Contrast Sensitivity System, the Vision Contrast Test System (VCTS) 6000, the VCTS 700S, the VCTS 6500 (Fig. 11.1), the B-VAT II-SG, the MCT 8000 and the Terry Vision Analyzer. **The VCTS 6000 and VCTS 6500 are the most commonly used.**

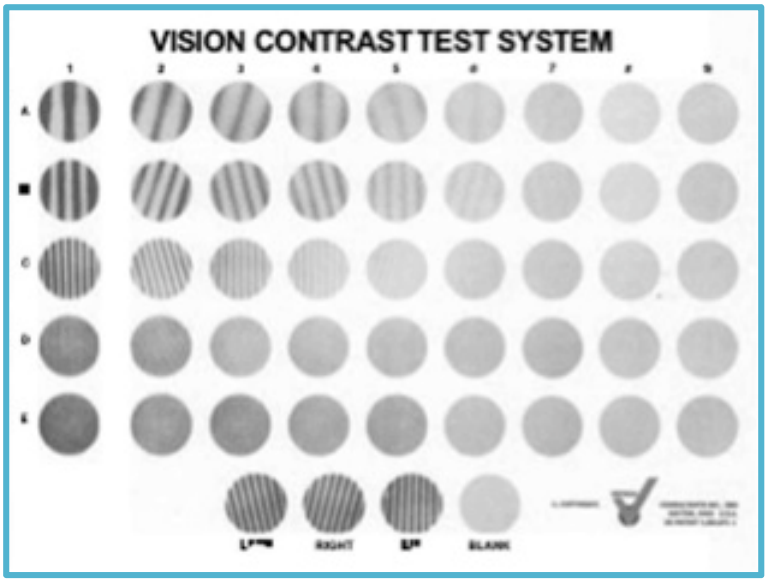

Figure 11.1: *VCTS 6500*

From Eskridge JB, et al, Clinical Procedures in Optometry

The contrast pattern or sinusoidal grating consists of alternating light (maximum luminance) and dark (minimum luminance) stripes. The contrast equals the difference between the maximum and minimum divided by the sum of the maximum and minimum.

$$\textbf{Contrast} = (L_{max} - L_{min}) / (L_{max} + L_{min})$$

Multiplying the ratio by 100 gives the contrast percentage. The visual angle between the stripes equals the **spatial frequency**.

The smaller the angle, the higher the spatial frequency and vice versa. In the normal population, **as spatial frequency increases, contrast sensitivity decreases** (Fig. 11.3)**.**

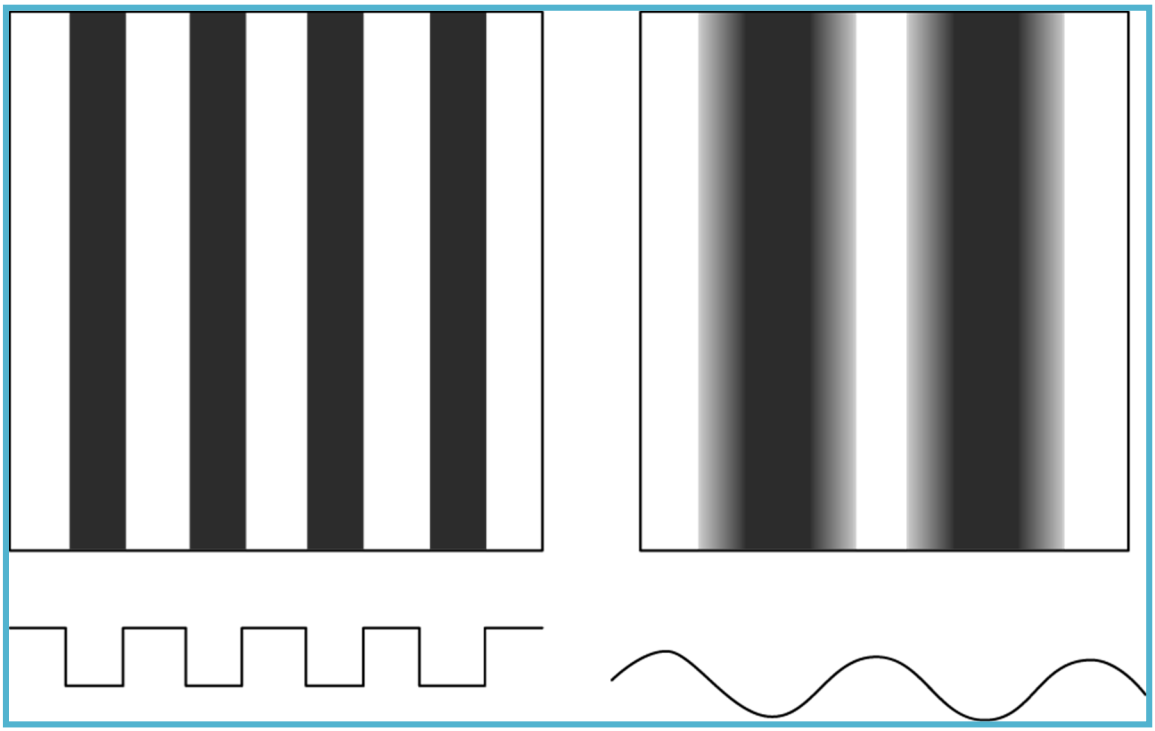

Figure 11.2: *Fringe Pattern*

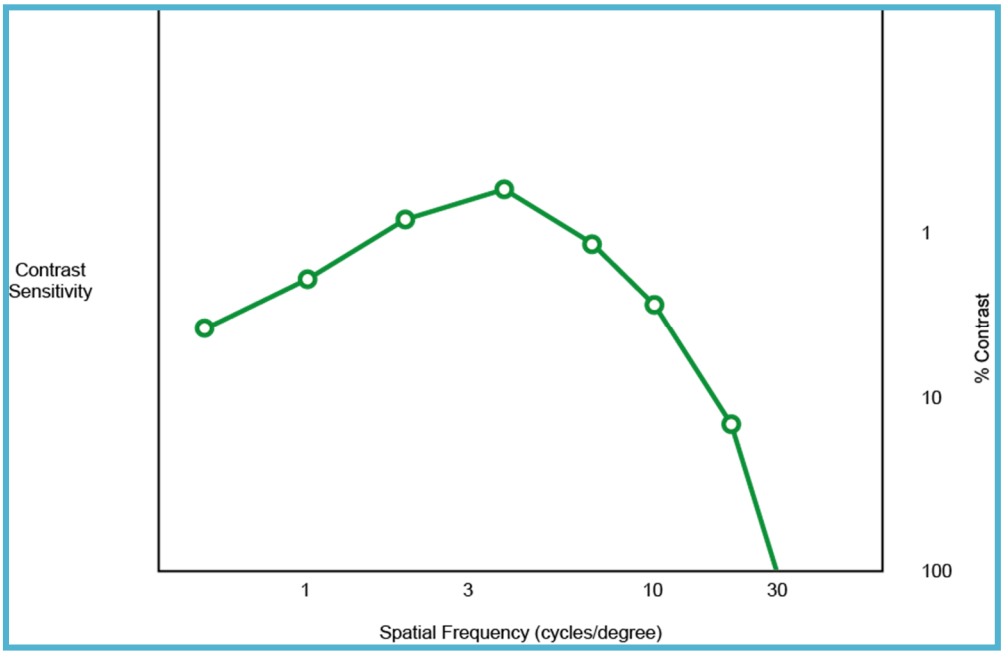

Figure 11.3: *Contrast Sensitivity Function (CSF): Spatial Frequency vs. Contrast Sensitivity*

Procedure

- Patient wears best Rx
- Contrast chart is uniformly illuminated
- Patient positioned at distance indicated by test
- Occlude non-tested eye
- Ask patient to identify orientation of stripe patterns
- Identify circle pattern orientation from left to right

- Endpoint for each row is the first incorrect response
- Document responses on an evaluation form and compare results to normal CSF.

CLINICAL RELEVANCE

Any disorder that damages a portion of the visual pathway has the potential to affect the CSF. When a patient manifests a **high spatial frequency loss,** it is closely related to a **decreased VA**. When a patient manifests a **low or medium spatial frequency loss**, it is related to **mobility deficits and/or facial recognition**.