

# Article ▶ Prevention, Correction, and Compensation Using the Range of Clarity

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## ABSTRACT

Most optometrists are taught to determine which lens produces the best acuity. Those who practice the art and science of optometry understand that there is a range of lens powers through which a patient can see clearly. The determination of a prescription is a negotiation between the clinician and the patient. This paper will introduce the concept of Range of Clarity and demonstrate its usefulness in the examination process and in determining the stage of refractive development.

**Keywords:** distance minus subjective test, distance plus subjective test, near minus subjective test, near plus subjective test, Range of Clarity, refractive development

## Introduction

The primary function of central vision is to permit a person to locate and finely discriminate an object of regard. This allows an individual to center on an area of attention and to profit from the detail. Central vision may be defined by the use of lenses. I refer to this central volume of space as the Range of Clarity (ROC).

In diopters, the ROC varies in volume from large to small as the object of regard increases in distance from the individual. At its largest, at the near point, the ROC can be as much as eight diopters. At its smallest, at the far point, the ROC can be as little as a quarter diopter. Generally, the near ROC is about four diopters, and the distance ROC is about two and a half diopters.

The ROC clearly demonstrates that there is a range of space within which fine discrimination is possible, not just a single point. The fact that individuals have a range of space for fine discrimination increases the prescription possibilities at distance and near.

Though the ROC has a physiological foundation, the volume of this space does increase and decrease as a result of individual experience. In fact, this central space can be manipulated by the judicious use of lenses. The reason one would want to manipulate the ROC is to allow an individual to locate an object accurately and quickly and to make available the maximum amount of usable information. In the event that an individual becomes aware of a decrease in performance, the ROC may be expanded or contracted as needed for enhancement. This ability to change the central space can be of tremendous benefit to patients. Hyperopia and myopia can be prevented or reduced.

The following subjective tests are performed binocularly when the patient has the ability to see 20/20 with each eye and the difference between each eye is no greater than a half diopter.

## Definitions and Procedures

### DPST: Distance Plus Subjective Test (Performed after the #5, dynamic retinoscopy)

- 1) Place enough plus lens power in the phoropter to blur the patient to 20/200 on the distance Snellen chart.
- 2) Decrease the plus lens power in quarter diopter steps as the patient reads down the chart.
- 3) Record the lens power when the patient can first read 20/20. (Add only as much cylinder as is necessary to attain 20/20.)

### DMST: Distance Minus Subjective Test (Performed immediately after the DPST)

- 1) Place enough minus lens power in the phoropter to blur the patient to 20/200 on the distance Snellen chart.
- 2) Decrease the minus lens power in quarter diopter steps as the patient reads down the chart.
- 3) Record the lens power when the patient can first read 20/20. (Add only as much cylinder as is necessary to attain 20/20.)
- 4) If the patient reports diplopia, record the lens power when the patient can see 20/20 and has single binocular vision. Diplopia indicates the presence of a binocular problem.

### DROC: Distance Range of Clarity – the algebraic difference of the lens power recorded for the DPST and the lens power for the DMST.

Examples:

DPST = +1.50 D	DPST = -2.00 D	DPST = +4.00 D
<u>DMST = -2.75</u>	<u>DMST = -5.00</u>	<u>DMST = +1.75</u>
DROC = 4.25	DROC = 3.00	DROC = 2.25

**DCOR: Distance Center of Range – the lens power in the middle of the DROC.**

Examples:

A.	B.
DPST = +0.75 D	DPST = +6.00 D
DMST = <u>-1.25</u>	DMST = <u>+2.25</u>
DROC = 2.00	DROC = 3.75
DCOR = -0.25	DCOR = +4.12

**Balance Test: (Performed to verify the DROC tests.)**

- 1) Place in the phoropter the DCOR lens power and have the patient look at the 20/20 line on the distance Snellen chart.
- 2) Add plus lens power in quarter diopter steps and record the lens power when the patient reports the first blur.
- 3) Place in the phoropter the DCOR lens power and have the patient look at the 20/20 line.
- 4) Add minus lens power in quarter diopter steps and record the lens power when the patient reports the first blur.

Compare the lens powers recorded. The range on either side of the DCOR should be the same or no more than a quarter diopter different. If the difference is a half diopter or more, the DCOR can be adjusted by half the difference.

Example: DCOR = -0.25 D  
Balance Test: +0.75 D/-1.75 D  
New DCOR = -0.75 D

The algebraic sum of +0.75 D and -1.75 D is -1.00 D. Half of -1.00 D is -0.50 D; add -0.50 D to the original DCOR (-0.25D), and the resultant is -0.75 D.

All the distance tests (#8, 9, 10, 11, 12, and #13B) are performed through the DCOR.

**NPST: Near Plus Subjective Test (Performed after the #19, amplitude of accommodation, which I do after the #15B)**

- 1) Place enough plus lens power in the phoropter to blur the patient to 20/200 on the Reduced Snellen Chart at the near test distance (usually 13" or 16").
- 2) Decrease the plus lens power in quarter diopter steps as the patient reads down the Reduced Snellen Chart.
- 3) Record the lens power when the patient can first read 20/30 (add only as much cylinder as is necessary to attain 20/30).

**NMST: Near Minus Subjective Test (Performed immediately after the NPST)**

- 1) Place enough minus lens power in the phoropter to blur the patient to 20/200 on the Reduced Snellen Chart at near (usually 13" or 16").

- 2) Decrease the minus lens power in quarter diopter steps as the patient reads down the chart.
- 3) Record the lens power when the patient can first see 20/30. (Add only as much cylinder as is necessary to attain 20/30.)
- 4) Should the patient report diplopia, record the lens power when the patient can see 20/30 and has single binocular vision. Diplopia indicates the presence of a binocular problem.

**NROC: Near Range of Clarity – the algebraic difference of the lens power recorded for the NPST and the lens power recorded for the NMST.**

Examples:

NPST = +1.50 D	NPST = +3.00 D	NPST = -0.75 D
<u>NMST = -1.50</u>	<u>NMST = -0.50</u>	<u>NMST = -2.00</u>
NROC = 3.00	NROC = 3.50	NROC = 1.25

**NCOR: Near Center of Range – the lens power in the middle of the NROC.**

Examples:

A.	B.
NPST = +2.75 D	NPST = +0.75 D
NMST = <u>+0.25</u>	NMST = <u>-2.00</u>
NROC = 2.50	NROC = 2.75
NCOR = +1.50	NCOR = -0.62

The NCOR is compared to the #14B Net (Fused Cross Cylinder Test) and should not be more than a half diopter different. The first lens power through which the #16, 17, 18, 20, and 21 are performed is usually a half diopter inside the range as indicated by the NPST. In example A, this lens power is +0.25D, and in example B, this lens power is +2.25 D.

For many years, my goal has been to help my patients maintain or increase their flexibility. To me, this has meant finding ways to decrease patients' prescriptions or to prevent the need for compensatory lenses. The following stages allow me to predict when a patient is beginning to move toward hyperopia or myopia, the degree of embeddedness, and the lens choices available for prescribing. For the purpose of discussion, I will presume all the other test results in the analytical are within the expected ranges. The following ROC test results have been selected to highlight certain stages and prescription possibilities. Astigmatism, amblyopia, anisometropia, and presbyopia are not included so that the basic concepts will be more apparent.

An acceptable equilibrium between plus and minus lens power at distance is any range from +/-1.00 D to +/-2.00 D. At near, the acceptable range is from +/-2.00 D to +/-4.00 D. The DCOR and NCOR are always plano when equilibrium exists. If the DCOR and/or NCOR are plano but the range is less than acceptable, the patient usually has an identification

problem. If the DCOR and/or NCOR are plano but the range is greater than acceptable, the patient usually has a centering problem.

Example:

DPST = +1.00 D    NPST = +2.00 D  
DMST = -1.00    NMST = -2.00  
DROC = 2.00    NROC = 4.00  
DCOR = 0    NCOR = 0

### Three Stages in the Development of Myopia

**Stage One:** DPST and NPST are in plus lens power. DMST and NMST are in minus lens power. DCOR and NCOR are in minus lens power.

Example:

DPST = +0.75    NPST = +1.50  
DMST = -1.75    NMST = -2.00  
DROC = 2.50    NROC = 3.50  
DCOR = -0.50    NCOR = -0.25

Stage One in the development of nearsightedness is characterized by the DPST and NPST lens powers in plus while the DCOR and NCOR lens powers are in minus. If the only subjective tests performed are the #7 and #7A, our initial impression might be that this patient is doing well and that lenses are not necessary at this time. By doing the DMST and the NMST, however, we may find enough minus lens power to shift the center of the range into minus. This indicates that the patient is beginning to show signs of myopia. To prevent further myopic adaptation and to bring the findings into equilibrium, I would prescribe +0.50 D (a quarter diopter inside the range) at distance with a +0.50 D add in bifocal form (+1.00 D is a half diopter inside the near range). If a half diopter add was not available, I would prescribe +0.25 D with a +0.75 D add (+1.00 is a half diopter less than the NPST).

The DPST, DMST, NPST, and NMST represent the edge of the patient's ranges and therefore the limit of the patient's ability to process fine detail. It's not a good idea to prescribe a lens that places a patient right at the edge of this ability. At distance, prescribe a lens a quarter diopter inside the range, and, at near, prescribe a lens a half diopter inside the range. In the example given for Stage One, a single vision distance prescription of +0.50 D and a single vision near prescription of +1.00 D are properly inside the range.

**Stage Two:** DPST, DMST, and NMST are in minus lens power. NPST is in plus lens power.

Example:

DPST = -0.50 D    NPST = +1.25 D  
DMST = -2.00    NMST = -0.75  
DROC = 1.50    NROC = 2.00  
DCOR = -1.25    NCOR = +0.25

Stage Two in the development of nearsightedness is distinguished by all the ROC test results in minus except the NPST, which is in plus. One might think that this patient is myopic, but the plus in the NPST means that minus acceptance is not complete. Therefore, there are a number of prescription possibilities available to the patient. For example, if the patient wanted only to see clearly at distance, I would prescribe -0.75 D. If the patient wants clear distance sight but at the same time wants to attempt to limit the myopia, I would prescribe -0.50 D at distance with a +1.25 D add in bifocal form. If the patient did not want to be myopic and enrolled in vision training, I would prescribe plano at distance with a +0.75 D add. During near point vision training activities, the training lens prescription will be +1.25 D.

**Stage Three:** DPST, DMST, NPST, and NMST are all in minus.

Example:

DPST = -1.00 D    NPST = -0.75 D  
DMST = -2.00    NMST = -2.75  
DROC = 1.00    NROC = 2.00  
DCOR = -1.50    NCOR = -1.75

Stage Three in the development of myopia is evidenced by the absence of plus lens power in the ROC tests. If the patient wants a compensatory prescription for distance, I would prescribe -1.25 D. If the patient wants good distance sight but would like to limit the myopia, I would prescribe -1.00 D for distance outdoors and -0.75 D for distance indoors. If the patient enrolled in vision training, I would prescribe -0.75 D (the least amount of minus in any of the ROC tests) for distance sight.

### Three Stages in the Development of Hyperopia

**Stage One:** DPST and NPST are in plus lens power. DMST and NMST are in minus lens power. DCOR and NCOR are in plus lens power.

Example:

DPST = +1.75 D    NPST = +3.00 D  
DMST = -0.75    NMST = -1.00  
DROC = 2.50    NROC = 4.00  
DCOR = +0.50    NCOR = +1.00

Stage One in the development of farsightedness is characterized by the DMST and NMST in minus lens power while the DCOR and NCOR are in plus lens power. Given no other information other than that the #7 is +1.75 D, one might conclude that this patient is a hyperope. By doing the DMST and NMST, we discover the amount of minus available. To obtain a better equilibrium and prevent true hyperopia, I would prescribe -0.50 D in clear and/or sun lenses for distance seeing.

**Stage Two:** DPST, DMST, and NPST are in plus lens power. The NMST is in minus lens power.

Example:

DPST = +2.25 D    NPST = +2.50 D  
DMST = +0.75    NMST = -0.50  
DROC = 1.50    NROC = 3.00  
DCOR = +1.50    NCOR = +1.00

Stage Two in the development of farsightedness features the DMST in plus and the NMST in minus lens power. As long as there is some minus apparent in one ROC test, it is possible to reduce the farsightedness. In this instance, I would prescribe -0.25 D in clear and/or sun lenses for distance seeing and recommend vision training. The -0.25 D is a quarter diopter inside the NMST. Unfortunately, this is the only minus left, so we have to use it. I have found that most patients can accept this near minus for distance seeing.

**Stage Three:** DPST, DMST, NPST, and NMST are all in plus lens power.

Example:

DPST = +1.50 D    NPST = +2.00 D  
DMST = +0.50    NMST = +1.00  
DROC = 1.00    NROC = 1.00  
DCOR = +1.00    NCOR = +1.50

Stage Three in the development of hyperopia is distinguished by the absence of minus lens power in the ROC tests. Compensatory lenses for a patient in this stage who hasn't worn lenses could be as little as +0.75 D (a quarter diopter inside the range) for distance. If the patient wanted better sight immediately and enrolled in vision training, I would prescribe +0.50 D. If the patient has been wearing lenses for compensation, then I would prescribe up to +1.25.

In Stage One, lenses may often be the only treatment needed to prevent the onset of hyperopia or myopia. Stage Two usually requires lenses and vision training. In Stage Three, the emphasis is on vision training, with lenses in a supportive role.

I have used the terms farsightedness, nearsightedness, hyperopia, and myopia. I have done this because I do not believe a person is a true hyperope if there is minus lens power available. I do not believe a person is a true myope if there is plus lens power available.

If you are caring for an established patient who wants compensatory lenses, it is not necessary to perform all the ROC tests. For the hyperope, only the DMST and NMST are needed. For the myope, only the DPST and NPST are necessary.

After years of studying the ROC, I have come to believe that there are four degrees of myopic and hyperopic embeddedness, which are indicated by the magnitude of the distance prescription.

- 1) up to +/-1.25 D
- 2) from +/-1.50 D to +/-2.50 D
- 3) from +/-2.75 D to +/-4.00 D
- 4) greater than +/-4.00 D

Hyperopes with a prescription up to +3.75 D can often be treated with lenses if there is minus acceptance. However, I think vision training should be emphasized when the prescription is between +1.50 D and +2.50 D. Myopes of any degree should be in a vision training program.

## Conclusion

The final prescription must be determined by assessing the relationships between all the tests in the analytical. The ROC tests, when added to the analytical, contribute to a more complete understanding of our patients and allow us to prescribe with greater assurance for a successful outcome.

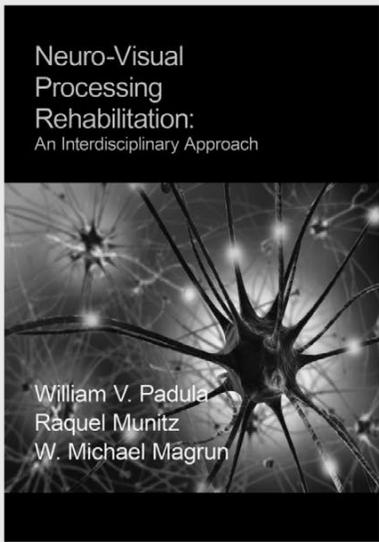
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# Neuro-Visual Processing Rehabilitation: An Interdisciplinary Approach

By William V. Padula, Raquel Munitz and W. Michael Magrun

Understanding how we see brings to mind the mythical story of the blind men and the elephant. Each responded to the part of the elephant that he encountered, and thus each had a very different impression of the animal. We are often so preoccupied with our conscious visual world that we describe it in limited ways and are thus unable to understand the comprehensive nature of vision. Research has shown that there is much more to visual processing than we have recognized. However, our limited understanding of vision and its multiple sensorimotor interactions have restricted our ability to work, through vision, to affect the rehabilitation of those who are neurologically challenged. The authors invite you to explore *Neuro-Visual Processing Rehabilitation* to learn new ways to think about vision. This book delves into the visual processing relationships of child development, motor and sensory interactions, and postural organization, led by vision, as the basis for understanding vision. From this knowledge, new directions and options will emerge for rehabilitation through the use of non-compensatory prisms and a new mode of treatment that the authors have termed Neuro-Visual Postural Therapy. The implications of understanding neuro-visual processing will change your thinking about vision as well as provide possibilities for helping millions of children and adults who have a neurological condition. Hardbound, 236 pages.

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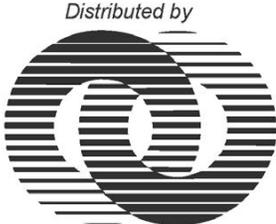
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