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Should the Worth Dot test be used to diagnose monofixation syndrome?

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Abstract
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Degree Type
Thesis

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Should the Worth Dot test be used to diagnose monofixation syndrome?

By
Student Researchers:
Amanda Galster
Kristi DeJong

A thesis submitted to the faculty of the
College of Optometry
Pacific University
Forest Grove, Oregon
for the degree of
Doctor of Optometry
May 2004

Faculty Advisor:
Bradley Coffey, O.D., F.A.A.O
Should the Worth Dot test be used to diagnose monofixation syndrome?

November 2003

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BIographies of the authors

Amanda Galster:

Amanda grew up in Hazen, North Dakota. She did her undergraduate studies at Jamestown College and received a Bachelor of Arts in Biology. After graduation Amanda looks forward to doing an optometric residency program.

Kristi DeJong:

Kristi grew up in Lynden, Washington. She did her undergraduate studies at Trinity Western University in Langley, British Columbia and then received a Bachelor of Vision Science from Pacific University. After graduation Kristi looks forward to a residency in vision therapy and pediatrics. She then plans to practice privately in Seattle, Washington.
ABSTRACT

Traditionally, the standard Worth Dot flashlight has been used to evaluate sensory fusion. Clinicians have also used the Worth Dot test in a “walk-away” manner to measure the size of a suppression scotoma in patients with abnormal fusion. Because the size of the flashlight targets and the distance from the patient are known, the practitioner can calculate the estimated size of the suppression zone. The size and location of this scotoma has been used to diagnose monofixation syndrome. However, there have been no studies to show that this suppression does not occur in patients with normal sensory fusion.

The primary purpose of this project was to establish normative data for the normal suppression responses on the walk-away Worth Dot procedure. Within our sample of observers with clinically normal binocular vision, we found that 66% reported transitory suppression at an approximate distance of 3.7 meters and 77% reported full suppression at an approximate distance of 4.5 meters as the Worth Dot test lantern was moved away. These results indicate that central suppression on the Worth Dot walk-away procedure is very common among normal observers.

A secondary goal of this study was to determine whether the walk-away suppression distance is related to the response on the distance Worth Dot test. It was hypothesized that those subjects who showed a suppression response on the distance Worth Dot would also suppress at a closer distance on the walk-away. The difference for full suppression was striking: subjects who demonstrated suppression on the distance Worth Dot test gave a suppression response on the walk-away at 1.1 meters closer that those who did not suppress on the distance Worth Dot.
INTRODUCTION

Form fusion is the blending of form information from the two eyes. This blending of visual information is the driving force behind good binocularity. Fusion includes both motor and sensory components. On a clinical basis, motor fusion involves the amplitude, precision, and speed of various ranges of vergence; sensory fusion describes the response of fusion or suppression. In clinical diagnosis, sensory fusion can be classified into three levels. First-degree fusion, described by Worth as superimposition of two dissimilar ocular images, requires stimulation of retinal areas having the same visual direction. Worth classified flat fusion as “second-degree fusion.” Flat fusion involves true fusion of similar ocular images into a two-dimensional construct. Third-degree fusion is called stereopsis and can be defined as, “Binocular visual perception of three-dimensional space based on retinal disparity.”

There are many different abnormalities of sensory fusion. Central suppression is an abnormality that prevents or disrupts fusion of the optical images in an area surrounding the fovea. The edge of the suppression zone can extend to five degrees from the center of the fovea. Beyond this limit, suppression is considered to be peripheral. Central suppression can be caused by small angle strabismus, anisometropia, and eccentric fixation. Central suppression due to eccentric fixation can usually be determined using visuoscopy. Another abnormality of sensory fusion is monofixation syndrome. Patients with monofixation syndrome have central suppression solely during binocular viewing. The diagnosis of monofixation syndrome includes the component of central suppression but also is dependent upon several other characteristics as discussed below. Differential diagnosis of central suppression and monofixation syndrome is important because of the difference in prognosis. Treatment prognosis of monofixation syndrome is generally considered to be
poor, while central suppression is often relatively easily managed. Therefore, it is important to correctly determine the clinical diagnosis.

Monofixation syndrome can be a difficult condition to describe, primarily due to the vast number of similar and overlapping definitions for closely related conditions. Some terms for related conditions that have evolved over the years are flick strabismus, fixation disparity, esophoria with fixation disparity, small angle esotropia, and retinal flicker. To gain a better understanding of what monofixation is, a brief historical evolution of the condition and its definition follows. The condition that is currently known as microstrabismus was first reported by Irvine in 1948. He described a syndrome where nonstrabismic anisometropic amblyopes produced a positive 4 base out test and whose corneal reflex produced reasonably good fixation. Irvine's report was followed by several other studies where similar conditions were described as retinal slip by Pugh, "esophoria with fixation disparity" by Gittoes-Davies, and "fusion disparity" by Jampolsky. The introduction of the term "fusion disparity" caused significant confusion, as the term is similar to fixation disparity, which was/is known as a completely different entity. In 1961, Parks reported a condition where the esodeviation found on alternate cover test (ACT) was larger than that found with unilateral cover test (UCT). He postulated that peripheral fusion was causing the UCT amount to be smaller. Parks called this condition "monofixational phoria". The term monofixation syndrome, as we know it today, was introduced by Parks in 1969. He wrote that there are multiple causes of monofixation syndrome, the most common being anisometropia, small angle strabismus, and unilateral macular lesion. Unilateral macular lesion is probably a different entity, though, owing to the fact that it is an organic problem and does not resolve under monocular conditions. With macular lesions, the resulting fixation anomaly is probably more appropriately termed eccentric viewing.
Monofixation syndrome as described by Parks\textsuperscript{10,11}, includes characteristics that are present in every monofixator and some characteristics that are only present in some monofixators. Parks\textsuperscript{11} defines the constant factors to include, "straight or almost straight eyes with a form of binocular vision that includes peripheral fusion but an inability to bifixate, evidenced by a scotoma in the visual field of the non-fixating eye during binocular vision," and, "Fusional vergence amplitudes are always associated with the monofixation syndrome." The scotoma referenced here is a suppression scotoma that disappears with monocular testing of the affected eye, and will hereafter be termed "central suppression" in this paper. The variable features that Parks\textsuperscript{11} associated with this syndrome include, "... a history of strabismus, anisometropia, a unilateral macular lesion, amblyopia, eccentric fixation, orthophoria, phoria, small tropia, possibly a larger deviation by alternate cover than by cover-uncover test." Also, "The majority of the patients with monofixation syndrome have gross stereopsis... ". In addition, it has been stated by Griffin and Grisham\textsuperscript{1}, that the deviation seen in monofixation syndrome is most commonly an eso deviation. Parks\textsuperscript{12} defines this further as "... of the strabismic patients who develop the monofixation syndrome after treatment, approximately 90 percent are esotropes and 10 percent are exotropes".

Depending on the factors present, the diagnosis of monofixation syndrome can include a variety of tests. The basis for the diagnosis is in the characteristics present\textsuperscript{10,11}: a suppression scotoma of approximately 3 degrees, peripheral fusion with fusional vergence amplitudes, and gross stereopsis of 60 to 3000 seconds of arc. The unilateral cover test will show a horizontal fixation movement between zero and eight prism diopters and a vertical
between zero and three prism diopters. Alternating cover test may show all possible responses: phoria, identical deviation to the unilateral, or greater deviation than unilateral. Therefore, no single response on the cover test is sufficient to identify the syndrome. Parks states that, “the diagnosis of monofixation syndrome can be made only by sensory investigation”. This sensory investigation should reveal the characteristics of the syndrome. A proposed flow chart for the diagnostic testing for monofixation syndrome is shown in Figure One.
No Movement or <8Δ

Alternating Cover Test

Orthophoria, Movement ≥ Unilateral CT

Worth Dot (Near)

Fusion Response

Walk Away Worth Dot

Loss of Fusion at < 2 meters

Binocular Perimetry

Test Target Disappears within 1.5-2.5° of Fixation Target

Baseolini Striated Lens Test

Gap Seen Within the Streaks (Scotoma = 3-5°)

Stereopsis

Stereopsis 3000"-67" of Arc

Monofixation

Figure 1. Proposed flow chart for the diagnosis of Monofixation Syndrome
Figure 2. Diagram of the Worth Dot test flashlight used in this study for the walk-away testing. The dimensions of this test were: four 6-millimeter colored dots spaced equidistant around a 34-millimeter diameter circle.

Figure 3. Diagram of the Distance Worth Dot test with dimensions of four 4-centimeter colored dots spaced equidistant around a 30-centimeter diameter circle.
Clinicians have also used the Worth Dot test in a “walk-away” manner to locate the size of the central suppression. It is best to begin the test at near with a handheld Worth Dot test lantern and move away from the patient. If the patient sees all four dots at near, the practitioner slowly moves away from the patient to the distance the patient reports suppression. Because the size of the flashlight targets and the distance from the patient are known, the practitioner can calculate the estimated size of the suppression zone. However, the literature includes no data to differentiate normal from abnormal suppression responses on the walk-away test. Thus, practitioners are left to use only their subjective clinical experience to determine normal from abnormal.

Because of the lack of this diagnostic data in the literature, the primary purpose of this project was to establish normative data for the normal suppression responses on the walk-away Worth Dot procedure. Secondary goals of the study were to determine whether the walk-away suppression distance correlated with the response on the distance Worth Dot test (Figure 3) and the responses on the BVAT acuity suppression test.

METHODS

The project was conducted in the Pacific University College of Optometry Vision Therapy Service, in Forest Grove, OR. There were three steps in the research protocol. Each of these steps occurred in a different clinic exam room. The first room included completion of the Informed Consent Form (Appendix 1) and the Study Intake Forms (Appendix 2). The pre-study screening took place in the second room. This room included a standard optometric exam lane and the Binocular Visual Acuity Tester. The third room was where the Worth Dot testing occurred. Each exam room had closed doors to ensure that the
subjects remained isolated from each other and had no prior knowledge of the study procedures or results. The experimenter that conducted the Worth Dot testing also had no prior knowledge of the subject's screening results. The ambient light level of the pre-study testing and the Worth Dot study rooms was determined to be 53 foot candles, as measured with a General Electric Type 213 photometer.

Sixty-five volunteer subjects were recruited from the first-year optometry class at Pacific University College of Optometry. There were 32 female and 33 male subjects and their ages ranged from 21 to 36 years. The study took place during the third week of class, when they were naïve to the Worth Dot test. Subjects first completed and signed the Informed Consent Form that described the study and its risks and benefits. Medications, history of ocular trauma/disease, and any systemic disease conditions were recorded by each subject on the Study Intake Form prior to the testing. The subjects' refractive condition was determined by one of the following methods:

1. Documentation of current prescription

2. Verification of current spectacle prescription with lensometry

Subjects were then tested to ensure that each met the following inclusion criteria.

- Absence of any systemic disease, ocular disease, or ocular trauma that might affect the outcome measure.
- Absence of any prescription pharmaceutical effect on visual function in regard to the study.
- Habitual (unaided or aided) visual acuity of at least 20/25 in each eye, tested at 6m and 40 cm with a Snellen projection slide and Snellen near point card, respectively.

\(^A\) BVAT; Mentor Ophthalmics Inc.
• Refractive condition of less than +/- 6.00 diopters sphere and less than 2.50 diopters of cylinder.
• Anisometropia of less than 1.00 diopter.
• Stereo acuity of at least 100 seconds of arc tested with the Wirt Circle near-point test.
• Heterophoria shown on distance and near cover tests.
• Normal response on an initial Worth Dot test at 33 cm.

The BVAT visual acuity suppression test was done after the completion of the inclusion criteria testing. The level of central suppression was measured using Snellen-type letters that were presented so that some were seen only by the right or left eye while others were seen by both eyes. A sample of the stimuli is illustrated below (Figure 4):

Stimuli:  F  Z  B  D  E
Seen by:  OU  OS  OU  OD  OU

The size of each line of letters was gradually reduced until the subject reported that one of the letters had disappeared. The visual acuity demand at which this suppression was first reported was recorded.

Fifty-four of the sixty-five volunteers met the inclusion criteria and proceeded individually to room three where fusion was assessed with the walk-away Worth Dot test and with the distance Worth Dot test. The Worth Dot test lantern used had dimensions of four 6-millimeter colored dots spaced equidistant around a 34-millimeter diameter circle (Figure 2), which is the typical clinical stimulus. This target size subtends a 6-degree angle on the retina of the subject at 33 cm and a 0.33-degree angle at 6m. The Worth Dot test lantern batteries were replaced every ten subjects. The subjects wore anaglyphic glasses over their habitual lenses with the red lens worn over the right eye and the green over the left.
Subjects were seated facing the experimenter as the following instruction set was read to the subject:

“How many dots do you see? What color are the dots? I am going to slowly move back away from you. As I do I want you to pay attention to two things. First, I want you to notice how many dots you are seeing and if the number changes, tell me what you see. Second, I want you to notice the colors of the dots you see and if the colors change, tell me what you see. Do you have any questions about these instructions?”

The experimenter began with the Worth Dot flashlight at a distance of 33 cm from the subject, then moved back along a tape measure at a rate of ten cm/second to a distance of 6 m or the distance where abnormal fusion (suppression or diplopia) was reported. The patient was instructed to blink every three seconds. Blink rate was controlled by the instruction set and experimenter observation. Each subject’s gaze was maintained in primary position throughout testing. Measurements were taken from the front of the cornea to the front surface of the Worth Dot flashlight. The distance where abnormal fusion was reported (“first suppression”) was recorded as the limit of normal sensory fusion. The subject was instructed to blink several times, and if normal sensory fusion returned the experimenter continued to move backward until fusion could no longer be recovered with blinking (“full suppression”). This distance was recorded. This process was repeated three times and the resulting distances averaged for each subject.

After the walk-away Worth Dot test was complete, each subject was shown the distance Worth Dot test to determine whether the subject was fusing or suppressing the target at 6 meters. The distance Worth Dot test had dimensions of four 4-centimeter colored dots spaced equidistant around a 30-centimeter diameter circle (Figure 3). The distance Worth Dot lantern was 6 meters from the subject in primary gaze. This test condition created an angular subtense of 3 degrees on the retina. The subject was asked, “How many dots do you see? What color are the dots?” The responses were recorded.
RESULTS

Table 1 shows the descriptive data for the tested subjects. The mean refractive condition for the sample studied was approximately –1.87 D sphere and –0.25 D cylinder. Habitual distance and near visual acuities were very precise with means of 20/15 and 20/20, respectively. The standard near Snellen card was limited at 20/20. The subjects also demonstrated good stereo acuity measured at 40cm with a mean of 40 sec arc.

<table>
<thead>
<tr>
<th>Test</th>
<th>Sphere OD (D)</th>
<th>Cylinder OD (D)</th>
<th>Sphere OS (D)</th>
<th>Cylinder OS (D)</th>
<th>DVA OD 20/</th>
<th>DVA OS 20/</th>
<th>NVA OD 20/</th>
<th>NVA OS 20/</th>
<th>Stereo (sec arc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>-1.88</td>
<td>-0.27</td>
<td>-1.87</td>
<td>-0.23</td>
<td>15.7</td>
<td>15.6</td>
<td>20</td>
<td>20</td>
<td>41.7</td>
</tr>
<tr>
<td>Std. Dev</td>
<td>2.00</td>
<td>0.45</td>
<td>2.05</td>
<td>0.45</td>
<td>2.45</td>
<td>2.31</td>
<td>0</td>
<td>0</td>
<td>4.2</td>
</tr>
</tbody>
</table>

Table 1. Refraction, visual acuity and stereo acuity for the tested subjects.

The suppression data for the walk-away Worth Dot test are described in Table 2. The number of subjects demonstrating either first suppression or full suppression was statistically examined. Chi square analysis showed that there were significantly (P < 0.001) more subjects who showed both first and full suppression responses than those who did not.

<table>
<thead>
<tr>
<th></th>
<th>First Suppression</th>
<th>Full Suppression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>mean (m)</td>
</tr>
<tr>
<td>Trial 1</td>
<td>34</td>
<td>3.65</td>
</tr>
<tr>
<td>Trial 2</td>
<td>37</td>
<td>3.73</td>
</tr>
<tr>
<td>Trial 3</td>
<td>36</td>
<td>3.65</td>
</tr>
<tr>
<td>Mean</td>
<td>36.68</td>
<td>0.763</td>
</tr>
</tbody>
</table>

Table 2. Results of walk-away Worth Dot Testing. The n's represent the number of subjects who suppressed in each condition on each trial. The means represent the average distance at which suppression occurred for those subjects who suppressed. The percentages represent the percent of the sample who suppressed on any given trial.

Subjects were divided into two groups based upon whether or not they demonstrated abnormal fusion on the Distance Worth Dot test. The distance at which
abnormal fusion occurred on the walk-away Worth Dot test was then compared for these
two groups using t-test analysis. The data are shown in Table 3. It can be seen that the
distance at which full suppression occurred on the walk-away was significantly (P=0.0011)
closer for those subjects who had abnormal fusion on the Distance Worth Dot. The distance
at which first suppression occurred on the walk-away nearly differed (P=0.0625) between the
groups, again suggesting that subjects who had abnormal fusion on the Distance Worth Dot
tended to suppress with larger targets (i.e., at closer distances) on the walk-away.

<table>
<thead>
<tr>
<th></th>
<th>Average First Suppression</th>
<th></th>
<th>Average Full Suppression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>mean (m)</td>
<td>s.d. (m)</td>
</tr>
<tr>
<td>Suppression</td>
<td>12</td>
<td>3.27</td>
<td>0.620</td>
</tr>
<tr>
<td>On Dist WD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Suppression</td>
<td>29</td>
<td>3.75</td>
<td>0.772</td>
</tr>
<tr>
<td>On Dist WD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probability</td>
<td>Df = 39</td>
<td>T Value = -1.918</td>
<td>Probability = 0.0625</td>
</tr>
</tbody>
</table>

Table 3. Distance at which suppression occurred on walk-away Worth Dot compared to the
presence or absence of suppression on distance Worth Dot testing. The n's represent the
number of S's who suppressed or did not suppress on the distance Worth Dot. The means
indicate the distance at which first suppression or full suppression occurred on the Worth
Dot walk-away for those same subjects.

Regression analysis was completed to determine whether subjects who suppressed at
a lesser distance on walk-away Worth Dot testing also suppressed at a larger acuity value on
the BVAT. The results of the BVAT testing were clustered with all subjects’ first
suppression between 20/15 and 20/40. Whereas, the results of the walk-away Worth Dot
test were quite variable. The lack of variability and leptokurtosis in the BVAT results made
the comparison between the two sets of data invalid.
DISCUSSION

The primary purpose of this project was to establish normative data for the normal suppression responses on the walk-away Worth Dot procedure. Within our sample of observers with clinically normal binocular vision, we found that 66% reported transitory suppression at an approximate distance of 3.7 meters and 77% reported full suppression at an approximate distance of 4.5 meters as the Worth Dot test lantern was moved away (Table 2). The angular sizes corresponding to these test distances is shown in Table 4. These results indicate that central suppression on the Worth Dot walk-away procedure is very common among normal observers. Therefore, if the Worth Dot walk-away procedure is used in the diagnosis of monofixation syndrome, the clinician must demonstrate Worth Dot suppression at distances much closer than we found in order to show evidence of abnormal central suppression.

<table>
<thead>
<tr>
<th>Distance of Worth Dot Flashlight (m)</th>
<th>Angular Sub-tense (deg)</th>
<th>First Suppression Mean = 0.54 degrees</th>
<th>Full Suppression Mean = 0.43 degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>1.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>0.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5</td>
<td>0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td>0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>0.43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td>0.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5</td>
<td>0.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0</td>
<td>0.33</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Nomogram showing the conversion from the Worth Dot walk-away suppression distance to the angular subtense of the suppression zone.

Significantly more subjects suppressed on the walk-away Worth Dot test than did not in our sample. Based on our data, an estimate of the range (mean ± 1 s.d.) of "normal" central suppression responses for first suppression was 2.9 - 4.4 m, and for full suppression, 3.4 - 5.7 m. If the clinician desires a more conservative estimate (mean - 2 s.d.) of abnormal
suppression distance, the values are 2.2 meters for both first suppression and full suppression. Based upon these values, a conservative clinical rule of thumb for abnormal suppression on the Worth Dot walk-away procedure is: Any suppression that occurs at a distance closer than two meters should be viewed as distinctly abnormal. The nomogram in Table 4 shows that this two meter distance corresponds with an angular subtense of one degree, approximately equal to the angular subtense of the foveal area.

This rule of “suppression inside two meters is abnormal” must be considered in light of variability in subject interpretation. It was observed that many subjects had difficulty determining if or when they regained fusion after first suppression. Some subjects also had trouble specifying whether they completely lost fusion or if there was a fluctuation between fusion and suppression. Given that our young adult subjects had difficulty with these distinctions, the clinical challenges of interpretation for pediatric patients are not insignificant.

A secondary goal of the study was to determine whether the walk-away suppression distance is related to the response on the distance Worth Dot test. It was hypothesized that those subjects who showed a suppression response on the distance Worth Dot would also suppress at a closer distance on the walk-away. This hypothesis was borne out for both first suppression and full suppression. The difference for full suppression is striking: subjects who demonstrated suppression on the distance Worth Dot test gave a suppression response on the walk-away procedure that occurred 1.1 meters closer than those who did not suppress on the distance Worth Dot. These results suggest the obvious: if the clinician chooses not to take the time to perform the Worth Dot walk-away procedure, useful information concerning central suppression can be gleaned by simply asking the patient to respond to the
distance Worth Dot test. This approach does not enable the clinician to estimate the size of the central suppression zone, but does provide at least nominal suppression information.

A more comprehensive study is recommended to enhance the clinical relevancy of this experiment. Such a study should include a larger and more diverse subject pool in the normative analysis. In order to test the validity of the “normal” suppression distances presented here, future studies should include subjects who have been definitively diagnosed with monofixation syndrome and perhaps other related anomalies. It would also be interesting to determine the other tests that are most commonly used in the clinical diagnosis of monofixation syndrome, and how those tests correlate with the Worth Dot procedures we studied.

Because a sensory evaluation is imperative in the diagnosis of monofixation syndrome, it is important to have a convenient clinical test that can be used in both specialty and primary care practice. Many practitioners already use the Worth Dot test as a quick and easy test of sensory fusion. Using the normative data for the walk-away Worth Dot procedure presented here, practitioners can have more confidence in their diagnosis of abnormal fusion in monofixation syndrome. By using an instrument that is familiar to many doctors, the number of false positive diagnoses of monofixation syndrome can be reduced. More precise diagnosis of monofixation syndrome will result in more accurate prognosis and treatment for those patients.
Unilateral Cover Test ➔ >8Δ Eso/Exo ➔ Strabismic

No Movement or <8Δ

Alternating Cover Test

Orthophoria, Movement ≥ Unilateral CT

Worth Dot (Near) ➔ Non Fusion Response

Fusion Response

Walk Away Worth Dot ➔ Loss of Fusion At > 2 meters ➔ Normal

Loss of Fusion at < 2 meters

Binocular Perimetry ➔ Superimpose Test and Fusion Targets ➔ Bifixator

Test Target Disappears within 1.5-2.5° of Fixation Target

Bagolini Striated Lens Test ➔ No Gap Seen within the Streaks

Gap Seen Within the Streaks (Scotoma = 3-5°)

Stereopsis ➔ Better than 67° of Arc

Stereopsis 3000°-67° of Arc

Monofixation

Figure 5. Recommended flow chart in the determination of a diagnosis of monofixation syndrome.
Appendix 1.

INFORMED CONSENT FOR PARTICIPATION IN A RESEARCH PROJECT

Pacific University College of Optometry

A. Title of Project: Should the Worth Dot test be used to diagnose monofixation syndrome?

B. Investigators: Bradley Coffey, OD, FAAO
Study Monitors: Amanda Galster and Kristi DeJong

C. Location: Pacific University College of Optometry Vision Clinic, Forest Grove, OR

D. Date: August 2002 to May 2003

E. Description of Project: In this study, we will investigate sensory fusion using the Worth Dot test as a way of diagnosing monofixation syndrome. Initially, common clinical distance and near tests will be performed to determine if subjects meet the study criteria. If the criteria are met, the subjects will be tested for sensory fusion from a distance of 33 cm to 6 m using the Worth Dot flashlight.

F. Description of Risks: The only known risks are associated with being in the location where the experiment is being conducted, putting on the red-green glasses and Binocular Visual Acuity Test (BVAT) goggles, and having confidential information released.

G. Description of Benefits: Results of this project will be used for evaluating the efficacy of the Worth Dot test in the diagnosis of monofixation syndrome. The data obtained will serve as a normative baseline of fusion and suppression in subjects with normal sensory fusion.

H. Alternatives advantageous to Subjects: There are no additional alternative procedures or courses of treatment.

I. Confidentiality: Records of this project will be maintained in a confidential manner and no name-identifiable information will be released.

J. Compensation and Medical Care: If you are injured in this experiment and it is not the fault of Pacific University, the experimenters, or any organization associated with the experiment, you should not expect to receive compensation or medical care from Pacific University, the experimenters, or any organization associated with the experiment.
K. Offer to Answer Inquiries: The experimenters will be happy to answer any questions you may have at any time during the course of this study. If you are not satisfied with the answers you receive, please call Dr. Karl Citek at 503-352-2126. During your participation in the project you are not a Pacific University clinic patient or client and all questions should be directed to the researchers and/or the faculty advisor who will be solely responsible for any treatment (except in an emergency). You will not be receiving complete eye, vision, or health care as a result of participation in this project; therefore, you will need to maintain your regular program of eye, vision, and health care.

L. Freedom to Withdraw: You are free to withdraw your consent and to discontinue participation in this project at any time without prejudice or consequences to you. I have read and understand the above. I am 18 years of age or over or this form is signed by and my parent guardian and me.

Printed name of subject ________________________________

Subject’s signature ____________________________________

Printed name and signature of parent or guardian if subject is under 18 years of age:

________________________________________________________________________________________

Address ____________________________________________

City/State ____________________________________________

Zip _________________________________________________

Phone ______________________________________________

Date ________________________________________________

Name and address of a person not currently living with you who will always know how to locate you:

________________________________________________________________________________________

Printed name and signature of interpreter if required:

_______________________________________________________________________________________
Appendix 2.
STUDY INTAKE FORM

Full Name

Glasses/Contact Lens Rx: R:  
L:

Medications and Reason for Taking it:

Eye Health History: Please circle below if you have any of the following:

Glaucoma  Cataracts  Macular degeneration  Eye turn  Lazy Eye

Please state the type of injury, surgery, or infection and when it occurred.

Eye injury

Eye surgery

Eye infection

Medical Health History: Please circle below if you have any of the following:

Diabetes  
High blood pressure  
Heart problems  
Thyroid problems  
Cancer  
Liver problems  
Kidney problems  
Stomach problems  
Nerve problems  
HIV/AIDS
WORKING BIBLIOGRAPHY

Cushman, Strabismus Diagnosis and Treatment. 1956.
REFERENCES