**Performance of the Spot Vision Screener in Children with Down Syndrome and Other Special Needs**

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### BACKGROUND

Amblyopia is the most common cause of preventable monocular vision impairment in adults and children.\(^1,2\) Amblyopia usually develops in the first five years of life and generally becomes irreversible after the age of 9.\(^3,4\) Highlighting the importance of early detection. Failure to diagnose and treat amblyopia has been shown to negatively impact a child’s visual acuity, contrast sensitivity, binocular vision, accommodation and even their reading ability and social development.\(^5,6\)

Children with Down Syndrome and other special needs are known to have high rates of amblyogenic risk factors such as refractive error and strabismus, thus it is not surprising that amblyopia disproportionally affects developmentally delayed children, being up to 3 times more common in one study.\(^7,8\) Amblyopia screening in special needs children can present a different set of challenges, however given their increased risk it is an extremely important part of their health maintenance. Photoscreeners, which require no verbal input from the child and can be performed with only minimal cooperation, offer potential advantages in detecting ARF in children with Down Syndrome and other special needs.

The Welch-Allen Spot Vision Screener (Spot) is a commonly used device for detecting amblyogenic risk factors. The Spot takes a photograph of the child’s eyes and determines approximately their refractive power, eye alignment and if there are any visual obstructions (such as ptosis or cataract). The test typically lasts 6 seconds and is without any known risks. Prior studies have reported good accuracy of Spot in the general population, however its performance in patients with Down Syndrome and other special needs is not substantiated.

### STUDY OBJECTIVE

Our study assessed the efficacy of Spot at detecting various amblyogenic risk factors in developmentally delayed children.

### METHODS

Children with various disabilities or delays were recruited from the CHC Eye Clinic, Special Care Clinic and the Sie Clinic. Participants had their photograph taken with Spot pre- and post-pupillary dilation, and this was then compared to a comprehensive eye exam in the Ophthalmology clinic.

### RESULTS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Able to be screened with Spot (n=83)</th>
<th>Not Able to be screened with Spot (n=17)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amblyogenic Risk Factor, n (%)</td>
<td>41 (49.4%)</td>
<td>5 (41.7%)</td>
<td>0.760</td>
</tr>
<tr>
<td>Other Chromosomal Abnormality, n (%)</td>
<td>11 (13.3%)</td>
<td>2 (16.7%)</td>
<td>0.667</td>
</tr>
<tr>
<td>In the table, the AUROC of the Spot was 0.67, which was not significantly different from the AUROC of the non-dilated SPOT 0.67 (p-value 0.54-0.81, p = 0.14).</td>
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### DISCUSSION

Our study found a high overall referral rate of 79% with an AUROC of 0.68, and a high sensitivity of 90% with specificity of 46%. These characteristics make Spot an excellent screening tool, where higher sensitivity is desired. Although the sensitivity of Spot was similar in our study compared to other with pre-verbal, non-developmentally delayed children, our referral rate was slightly higher. This may be due in part to the higher prevalence of amblyogenic risk factors as well as the referral criteria we used. We used the manufacturer referral criteria since this is what is likely to be used in a real-world situation. To determine if their cycloplegic refraction at the visit with Ophthalmology was clinically significant refractive error, we used the American Academy of Ophthalmology’s Preferred Practice Pattern (PPP) guidelines for refractive correction in infants and young children. These guidelines are based on expert consensus and not specifically written for special needs children, however the PPP are widely used by pediatric ophthalmologists for all children, and since there are no dedicated guidelines for this population we chose to use the most standardized recommendations available.

### LIMITATIONS

None of our participants had an untreated cataract and very few had non-refractive and non-amblyogenic risk factors such as significant ptosis, which limited our evaluation of the Spot for these risk factors. Finally, not all children had both a undilated and a non-dilated Spot image.

### REFERENCES


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**Example of printout from Spot screener.**

**Figure 1. Receiver Operator Curve for overall accuracy of Spot Vision Screener in undilated special needs children.**

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**Table 1: Characteristics of participants by ability to be screened with Spot**

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Note: Determined from their Ophthalmic cycloplegic refraction and based on the American Academy of Ophthalmology Preferred Practice Pattern for Refractive Correction.