# Article ▸ Treatment of Anisometropic Amblyopia Using Bangerter Foil and Vision Therapy

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## ABSTRACT

**Background:** There are many approaches to treating amblyopia; opaque patching is one of the most common. However, opaque patching is known to have limited patient compliance due to poor cosmesis and social stigma. Partial occlusion with translucent Bangerter foils is a viable alternative to opaque patching.

**Case Report:** JR, a 12-year-old Caucasian male with refractive amblyopia, was referred for a vision therapy evaluation. In addition to reduced acuity of 20/50- OS, JR exhibited decreased accommodative and oculomotor skills. JR was fitted with a 0.3 Bangerter foil OD over his glasses to be worn 2-3 hours per day. JR was enrolled in weekly vision therapy and re-evaluated after 10 and 20 sessions. After his 20-week progress check, JR's acuity improved to 20/30 OS. JR also reported a subjective improvement in reading ability and a decrease in frequency of headaches.

**Conclusion:** Bangerter foils are an acceptable alternative to opaque patching for amblyopia treatment. When combined with active vision therapy, patients can see an increase in visual acuity, accommodative skills, and oculomotor control.

**Keywords:** amblyopia, anisometropia, Bangerter foil, vision therapy

## Introduction

Amblyopia is one of the leading causes of decreased vision in children, with some studies showing that it can affect up to 5% of the population.[1] Amblyopia is classified as the reduction of best-corrected acuity to 20/40 or worse in one eye or a two-line difference in acuity between the eyes, in the absence of pathology.[2] Anisometropic amblyopia occurs secondary to significantly unequal refractive error between the two eyes.[3] There are many approaches to treating anisometropic amblyopia. The first step is to prescribe the appropriate compensating lens.[4] Prescribing philosophies may vary between doctors, but the overall goal is to prescribe the amount of power that leads to best-corrected visual acuity. A common issue with glasses for anisometropic amblyopia is that the difference in lens power between the eyes causes a difference in spectacle magnification, as well as a noticeable difference in lens thickness.[5] In order to eliminate the magnification concerns, contact lenses are an excellent choice for these patients. As a contact lens fits directly on the eye, when the patient is looking outside of primary gaze, the lens is able to move with the eye, thereby reducing visual aberrations and distortions.

For about 25% of patients, full-time refractive correction can improve acuity to normal levels.[6] If acuity is still decreased in the amblyopic eye after adjusting to the prescribed lenses, further treatment should be considered to improve visual acuity. Opaque patching has long been the standard treatment in amblyopia.[7] While patching is known to lead to increased acuity, patient compliance and quality of life is a hindrance to achieving the best quality outcome.[8] Partial occlusion with Bangerter foils provides an alternative to opaque patching. Bangerter foils, first used in the 1960s, are translucent filters that decrease acuity by various amounts.[9] The foil is applied over the spectacle lens of the non-amblyopic eye. The level of the filter that is chosen degrades the visual acuity of the non-amblyopic eye to roughly the same level as that of the amblyopic eye.

In addition to reduced acuity, amblyopic patients have a tendency to have decreased visual skills in many other areas, including accommodation, oculomotor dysfunction, and stereopsis.[10] Active vision therapy is a viable option for all amblyopic patients in order to help develop these visual skills.[11] This case report shows how a combination of contact lenses, Bangerter foils, and active vision therapy can lead to increased visual acuity, improved visual skills, and better quality of life for amblyopic patients.

## Case Report

Patient JR, a 12-year-old white male, presented for a vision therapy evaluation due to a previous diagnosis of refractive amblyopia. JR was diagnosed with refractive amblyopia one year prior by his previous optometrist. He was given glasses and was advised to use a total occlusion patch for two hours per day over his non-amblyopic eye. JR and his mother reported that they followed the prescribed patching guidelines for the first six months. His refraction, reported from his previous optometrist, was plano OD and +3.00 -0.75x010 OS. They reported noticing slight improvement, but after a few months, they noticed no further changes. At the time of his first visit, JR had not been patching for several months. He had been fit by his previous optometrist for a contact lens to be worn in his amblyopic eye only. Since initiating contact lens wear, JR reported no longer using his

**Table 1. Examination Findings from the Initial and Progress Evaluations**

| Test | Initial Visit | 10 week progress | 20 week progress |
|---|---|---|---|
| Distance VA OS | 20/50- | 20/50+1 | 20/30 |
| Near VA OS | 20/40- | 20/50+2 | 20/40 |
| Stereoacuity | 30 sec | 50 sec | 40 sec |
| Accommodative Lag (MEM) | OD +0.75<br>OS +2.50 | OD +0.75<br>OS +1.00 | OD pl<br>OS +0.75 |
| NPC | Break 4 cm<br>recovery 6 cm | To the nose | To the nose |
| Accommodative Facility (+/- 2.00 D) | OD 14 cpm<br>OS 12 cpm<br>OU 3 cpm | OD 15 cpm<br>OS 13 cpm<br>OU 1 cpm | OD 16 cpm<br>OS 15 cpm<br>OU 20 cpm |
| King-Devick | 63 seconds<br>(11 year old level) | 54 seconds<br>(12 year old level) | 50 seconds<br>(14 year old level) |
| Accommodative Amplitude | OD 11 D<br>OS 8 D | OD 11 D<br>OS 8.5 D | OD 14 D<br>OS 12 D |

glasses. JR also reported that he experienced headaches during 3D movies and while he was reading. JR's mother reported that he used to read more as a child, but she had noticed a decrease in the amount of time that he spent reading. He was in advanced placement classes at school but reported difficulty with reading speed and comprehension.

JR's distance visual acuity was 20/50- OS at the time of his initial presentation, with 20/40- at near. Additional relevant clinical data can be found in Table 1. In addition to decreased acuity, JR also displayed reduced accommodative findings in his amblyopic eye. As JR reported difficulty with reading speed, the King-Devick Saccadic Test was administered, and JR tested at an 11-year-old level. Cover test was ortho at both distance and near, showing that there was no significant ocular alignment issue contributing to JR's visual difficulties. Refraction showed no change from his initial prescription, and no improvement in distance acuity was observed. JR and his mother expressed an interest in any options available to improve acuity in his amblyopic eye. He was fit with a 0.3 Bangerter filter over his glasses, which reduced his acuity OD from 20/20 to 20/60. He was instructed to wear his contact lens during the school day and switch to the glasses for 2-3 hours at home each night. It was emphasized that at least one hour of near-point activities should be performed when using the glasses/filter. In addition to the Bangerter filter, JR was enrolled in weekly in-office optometric vision therapy. JR and his mother were given an estimate of six to nine months to complete therapy, and re-evaluations were to be performed every 10 weeks.

JR was motivated and showed good compliance throughout therapy. Vision therapy focused on accommodation, oculomotor skills, peripheral awareness, and anti-suppression activities. Monocular accommodative skills were emphasized first in order to equalize skills between the amblyopic and non-amblyopic eyes. Once monocular skills were equalized, bi-ocular and anti-suppression activities were introduced. Most of the accommodative activities focused on accommodative rock procedures, in which JR would alternate between stimulating and relaxing his accommodation. This allowed him to build increased ranges of accommodation and to establish better control. Oculomotor techniques emphasized establishing the ability to isolate and control eye movements while eliminating head and body movements. Hand-eye coordination was also integrated into oculomotor training with activities such as Marsden ball catches and pointer straw. When working on binocular activities, it is important to ascertain that the patient is truly using both eyes and is not suppressing the weaker image from the amblyopic eye. Red-green glasses with corresponding red-green filters were used often throughout therapy. Activities done in a standing stereoscope, such as cheiroscopic tracing, were also aimed at eliminating suppression. Early activities took place in free space to establish control in a natural environment. As therapy progressed, more in-equipment activities were added in order to allow the patient to maintain control of his eyes within an artificial space. Therapy sessions lasted 45 minutes each week, and JR was given 15-20 minutes of home therapy activities to do. He was re-evaluated after 10 and 20 sessions of vision therapy. The relevant findings of his vision therapy evaluations are summarized in Table 1.

In addition to a noticeable improvement in visual acuity, JR also reported a decrease in his headaches and was able to appreciate 3D movies without getting headaches. He reported increased reading with improved comprehension. While further improvements might have been seen with continued therapy, JR was given a two-month break from weekly therapy sessions due to personal reasons. He was instructed to continue to wear his glasses with the Bangerter filter for 2 hours per day, with one hour of suggested near work.

## Discussion

Bangerter filters are graded based on the decimal acuity of the predicted visual acuity outcome when placed over the non-amblyopic eye.[12] Bangerter filters are available in the following strengths: <0.1, 0.1, 0.2, 0.3, 0.4, 0.6, 0.8, and 1.0. Several studies have been done to examine the level to which various strengths of Bangerter filter degrade patients' visual acuity. While it was shown that Bangerter filters decrease acuity relative to a patient's baseline, the amount is inconsistent. Bangerter filters labeled 0.3 and 0.2 are expected, by the manufacturer, to decrease visual acuity to approximately 20/70 and 20/100, respectively. One study showed that 66% of subjects using 0.3 filters decreased to acuity of 20/70 or worse, and only 26% of subjects wearing 0.2 filters decreased to the expected level of 20/100 or worse.[12] Keeping in mind this inconsistency, it is important always to measure visual acuity in each patient with the Bangerter filter in place prior to dispensing it for regular wear. The study also showed that the average amount of reduction in acuity at the 6- and 12-week follow-ups was decreased from the initial

visit. This could be due to degradation in the material of the filter with prolonged wear or secondary to patient adaptation to the blur caused by the filter. In order to maintain the same level of blur, it is recommended to replace the filter regularly. In comparing the measured acuity of visually normal adults and amblyopic children, the amount of degradation by each filter strength was found to be similar.[13] While most studies on visual acuity changes with Bangerter foils focus on distance acuity, Odell et al. found a smaller amount of reduction in near acuity for each filter strength when compared with distance acuity reduction. As near activities are often encouraged during amblyopia therapy, further consideration should be paid to near acuities with Bangerter foils.[14]

A recent PEDIG study compared full-time wear of Bangerter foils to two hours of daily opaque patching in children aged 3 to <10 years in patients with moderate amblyopia (20/40 to 20/80).[9] Results were compared with regular follow-up over a 24-week period. Patients using the Bangerter foils improved on average by 1.9 lines of acuity by the 24-week follow-up, and patients using opaque patching improved on average by 2.3 lines over the same period. Thirty-eight percent of patients with Bangerter foils improved by greater than three lines of acuity compared to 35% of opaque-patched patients. The Parental Amblyopia Treatment Index (ATI) was used to compare the potential negative impacts of treatments.[15] The Bangerter foil group scored consistently lower on the ATI, indicating decreased negative impacts when compared to opaque patching. Due to the fact that there was less than half a line difference in acuity improvement between Bangerter foil treatment and opaque patching, it was concluded that Bangerter foils are a reasonable alternative to opaque patching for patients with moderate amblyopia.

The major disadvantage of opaque patching is reduced compliance secondary to patient discomfort, social stigma, and poor understanding of the necessity of treatment. Compliance with the prescribed amount of opaque patching has been found to vary between 45% and 68% of patients, while only 30% of amblyopic patients showed poor compliance with spectacle wear alone.[8] As Bangerter filters are placed on the glasses instead of the skin and are not readily apparent to outside observers, this suggests that compliance with Bangerter filters would be increased when compared to that of opaque patching. Further studies need to be done in order to quantify the improvement in compliance with Bangerter filters compared to opaque patching.

## Conclusion

There are many approaches available when treating amblyopia. Factors such as compliance, long-term efficacy, and patient quality of life should be considered when choosing a treatment strategy. Bangerter foils have been shown to be an effective alternative to opaque patching while eliminating some of the discomfort and social stigma associated with patching. Adding active vision therapy to the use of Bangerter foils allows amblyopic patients to improve their overall visual skills. By combining multiple treatment strategies, the patient is provided with a better chance of success with amblyopia therapy.

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