Modified Method for Assessment of the Binocular Fusional Field in Patients with Suppression

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Abstract

Purpose: To evaluate the usefulness of a new system using a modified Goldmann perimeter and Bagolini striated glasses for quantitative assessment of the binocular fusional field (BFF) in patients with suppression.

Methods: The BFF was assessed quantitatively in ten normal patients aged 10 to 15 years by using a modified Goldmann perimeter equipped with a xenon light source. Subjective perception was elicited with the use of a crossed or single oblique streak through Bagolini striated glasses. The BFF in 15 strabismic patients with suppression were analyzed at their initial visit and at their last visit after therapy.

Results: In normal patients, extent points of the BFF on every 15° meridian ranged from 48° to 56°. The normal BFF drawn from these average points was approximately equal to the previously published normal format of binocular single vision for strabismic patients with diplopia. Additionally, this scoring system for BFF provided quantitatively objective information during the course of their extraocular disorder in 15 strabismic patients with suppression.

Conclusion: This new method of assessing BFF in patients with suppression can be helpful for evaluation of quantitative effects in the course of treatment for an extraocular disorder and compensatory abnormal head position.

Key Words: Bagolini striated glasses, fusion, Goldmann perimeter, strabismus, suppression

Introduction

It is widely accepted that the ideal goal of management of patients with early-onset strabismus is recovery of binocular fusion from the suppression that occurs as the sensory sequela to the heterotropia. If a patient with heterotropia reports no diplopia, several tests, such as the Worth four-dot test, the Bagolini striated glasses test, synoptophore, 4Δ base-out prism test, or the red glass test, can be applied to help evaluate the sensory state and to allow differentiation between fusion and suppression.³ However, most of these tests can be used only for a qualitative response in the primary position or in the nine diagnostic positions of gaze. Unfortunately, very few examinations can be used to quantify the binocular fusional field (BFF) in patients with suppression.

In 1974, Feibel and Roper-Hall used the III-4e target of the Goldmann perimeter to quantitatively assess the field of binocular single vision (BSV) in patients with diplopia.²³⁻⁸ This test can be used to clearly separate the field of BSV from that of double vision and is useful for estimating the quantitative effects of the surgical procedure selected for an acquired extraocular disorder. However, patients with suppression are not conscious of the diplopia that defines the extent of the BSV field, so this method cannot be used to conduct quantitative assessments of the BFF in patients with suppression. The Bagolini striated glasses test can easily differentiate between fusion and suppression, even if the patient has childhood strabismus and shows anomalous retinal correspondence (ARC) leading to some degree of
binocular fusion. By using a modified Goldmann perimeter and Bagolini striated glasses, we have developed a new quantitative technique to assess the BFF in patients with suppression.

The first purpose of this study was to determine the fully normal BFF and calculate a BFF score. The second purpose was to evaluate the usefulness of this test by comparing the BFF score before and after either strabismus surgery or prism therapy.

Methods and Materials

Apparatus and Methods

Since an illuminated spot target on the bowl surface of the Goldmann perimeter (Inami, Tokyo, Japan) was unable to cause a subjectively elongated streak on the Bagolini striated glasses, we removed the halogen bulb of the Goldmann perimeter and replaced it with a xenon light source (Fig. 1). Although the modification caused a loss of background illumination on the bowl surface, the size of the new spot target was the same as the V-4e setting. In addition, the increase in the excitation power caused a subjectively elongated streak with Bagolini striated glasses. Figure 2 shows simulations of crossed streaks as binocular fusion (left) and a single oblique streak as suppression (right).

Each subject had special Bagolini striated glasses that were enlarged to eliminate the influence of the frame on artifacts in the periphery of the BFF. The glasses were made in such a manner that the axis of striation was oriented at 135° for one eye and 45° for the opposite eye. The head and chin rests were positioned to keep the subject’s head erect and so that the central fixation target was centered between both eyes at eye level. The target on the bowl, rather than a point of light, was moved peripherally, while the head did not move and both eyes were open. The point at which the subject first noticed the change from the subjectively crossed streaks to a single oblique streak was recorded on the Goldmann chart.

The points of the BFF were randomly plotted on every 15° meridian, and the boundary was then traced through the 24 points. The area within the boundary was considered to be the BFF and used to quantitatively calculate the BFF score, as previously described by Sullivan et al.1 to assess the BSV field. On the scoring template, scores were ranged from 1 to 3 and higher values were assigned to segments of the primary and reading positions (Fig. 3). The total possible score for all 50 segments was 100 points, thus allowing for the BFF score to be directly converted to a percentage. Each of the segments was labeled with a central figure, and the segment was scored only when the central figure was within the boundary of the BFF.

Subjects

The Institutional Review Board of Yagasaki Eye Clinic approved this protocol, and signed informed consent was obtained from all study subjects prior to participation. To establish the normal extent of the BFF, ten normal