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### Liquid Crystal Glasses: Feasibility and Safety of a New Modality for Treating Amblyopia

**A**mblyopia is the most common cause of monocular visual impairment.<sup>1,2</sup> Strabismus and anisometropia occurring during childhood are risk factors for amblyopia leading to various levels of poor vision and different responses to currently available treatments.<sup>3-5</sup>

To overcome the unknown factor of a child's compliance, avoid the blemish of a mechanical patch, and enhance the child's willingness to undergo the antiamblyopic regimen, electronically controlled liquid crystal glasses have been developed. Application of a small electric charge changes the spatial orientation of the suspended crystal molecules within the glasses. Thus, alternation between transmission of light (transparent) or opacification can be achieved at will. A liquid crystal lens in front of the sound eye is used as an intermittent flickering shutter switched between "on," or occlusion (Figure 1), and "off," or light transmission (Figure 2).

For the preliminary evaluation, a pattern of 45 seconds on and 55 seconds off was used. Ten consecutive children (mean±SD age, 74.3±10.3 months; range, 65-93 months) fulfilling the inclusion criteria for the study were enrolled. During the first enrollment examination (visit 0), a thorough eye examination including cycloplegic refraction was performed. Liquid crystal glasses with the appropriate correction were ordered and the child was invited for reevaluation with the new liquid crystal glasses (visit 1). A follow-up visit was scheduled 5 weeks later (visit 2). Statistical analysis of differences in



**Figure 2.** Clear view for the sound eye with the "off" position of the liquid crystal glasses.



**Figure 1.** Occlusion of the sound eye with the "on" position of the liquid crystal glasses.

**Table 1. Visual Acuity for Distance During Visits 1 and 2**

Patient No.	Visual Acuity for Distance*	
	Visit 1	Visit 2
1	0.2	0.2
2	0.2	0.2
3	0.3	0.6
4	0.3	0.3
5	0.2	0.2
6	0.3	0.4
7	0.2	0.2
9	0.3	0.3
10	0.3	0.3

\*Visual acuity for distance is expressed as the Snellen decimal score. The mean±SD visual acuity for distance was 0.25±0.05 for visit 1 and 0.30±0.13 for visit 2;  $P = .22$  for the mean visual acuity for distance at visit 1 vs visit 2.

visual acuity (Snellen decimal score) was performed using a 2-tailed  $t$  test.  $P < .05$  was considered statistically significant.

Nine children wore the liquid crystal glasses during all waking hours and were not disturbed in their daily routine. The mean visual acuity for distance after 5 weeks (visit 2) is shown in Table 1. Although some improvement in the visual acuity had been achieved, the differences did not reach statistical significance ( $P = .22$ ). However, the mean near visual acuity differences (Table 2) reached statistical significance ( $P = .02$ ). Slitlamp and indirect funduscopy did not show any changes during all of the visits.

This study demonstrates that liquid crystal technology can be used for glasses to be able to provide an electronic, controlled, intermittent occlusion of the sound eye allowing for visual stimuli input to the amblyopic fellow eye. We have observed that wearing liquid crystal glasses is safe and does not induce any adverse effects. Liquid crystal glasses achieve the patching effect of a mechanical patch for the sound eye without its cosmetic blemish and without the constant awareness of its presence by the child and his or her environment.

The possibility of manipulating the flickering sequence and adapting it to the depth of amblyopia, the length of needed treatment, and the patient's age while using this device may result in paramount treatment benefits.

**Table 2. Visual Acuity for Near During Visits 0 and 2**

Patient No.	Visual Acuity for Near*	
	Visit 0	Visit 2
	1	0.5
2	0.3	0.5
3	0.3	0.5
4	0.2	0.5
5	0.4	0.5
6	0.2	0.5
7	0.5	0.5
9	0.5	0.5
10	0.5	0.5

\*Visual acuity for near is expressed as the Snellen decimal score. The mean  $\pm$  SD visual acuity for near was  $0.38 \pm 0.13$  for visit 0 and  $0.50 \pm 0.00$  for visit 2;  $P = .02$  for the mean visual acuity for near at visit 0 vs visit 2.

To enhance the significance of these preliminary data observations, a larger controlled clinical trial enrolling more patients and following them up for a longer period is needed and is now being planned.

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## The Eyes, Brain, and Bones of Johann Sebastian Bach

It is true indeed, in this era of specialization, that we tend to look more and more with tunnel vision and sometimes neglect the fact there is more out there than our own area of expertise. This makes us more reactive. colleagues in other disciplines most like the suggestion of Breitenfeld that Bach might have suffered (mild) strokes,<sup>1</sup> at least 1 in or before 1746 (the year Hausmann depicted Bach on a portrait), and one in July 1750, about 2 weeks for his death.

Since Bach died more than 250 years ago, it seems unlikely the truth will be unravelled anymore. We did try to get closer, though, by proposing a detailed scientific plan to examine the alleged remnants of Bach that are kept in the Thomas Kirche in Leipzig (Germany). Goals were to establish whether it is likely or not that the skeleton belongs to Bach by means of DNA research and to find DNA clues for disease. Unfortunately, this plan recently was rejected by the directory board of the Thomas Kirche.

Retrospective research on subjects like this is always complicated by limited medical documentation, as is especially the case with Bach. Due to the fact that Bach's surgeon Taylor left a large written scientific heritage, it is possible to tell something about the operations. Not all left by Taylor is accurate and useful, as he mentions Bach in his 1761 memories, incorrectly stating that Bach was 88 years old, the operation was successful, and Handel was a pupil of Bach.<sup>2</sup>

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