Intermittent exotropia: are we underminusing by not overminusing?

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Invited Commentary

Intermittent exotropia: are we underminusing by not overminusing?

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Intermittent exotropia may be the most treatable yet the most incurable form of strabismus.[1] The optimal timing of any surgical treatment has been vigorously debated. One study found that up to 86% of "successfully" treated patients require repeat strabismus surgery for recurrent exodeviations within 15 years of initial surgery.[2] Many patients are therefore treated conservatively with observation, part-time occlusion of one or both eyes, or over-minus lenses to force accommodative convergence to augment esotonus and thereby control the deviation during periods of fixation.[3,4]

Numerous studies have documented moderate success with over-minus therapy,[4-8] but many practitioners report anecdotally that the intermittent exotropia reverts back to its previous level of control once this therapy is discontinued. Despite the fact that children have ample accommodative reserve, some ophthalmologists instinctively dislike inflicting unnecessary accommodative demands on children with negligible baseline refractive errors. Recent reports of myopia in children with intermittent exotropia have further dampened enthusiasm for this treatment,[9] despite the fact that several studies have found that over-minusing has no detectable effect on myopic progression.[7,10]

Recent experimental studies suggest that targeting accommodation may play a pivotal role in controlling intermittent exotropia, albeit not the one that is classically understood. Horwood and colleagues have proposed that the therapeutic use of "over-minus" lenses in intermittent exotropia could *eliminate* blur and promote *fusional* convergence rather than *induce* blur and stimulate *accommodative* convergence, as is commonly held.[11] These investigators used a remote haploscopic video refractor to separately manipulate blur, disparity, and proximal "looming" cues while simultaneously monitoring accommodation and vergence angles.[11-13] They found that disparity cues provide the primary drive for both convergence and accommodation in

normal subjects[12] and in subjects with intermittent exotropia.[11] Furthermore, patients with intermittent exotropia under-accommodate in the exotropic state and over-accommodate in the orthophoric state.[11] Patients with intermittent exotropia seem to use disparity-induced vergence cues to restore binocular alignment, with greater convergence stress demand during near fixation triggering over-accommodation, and possibly promoting the development of myopia over time.[11] Other investigators have used different methodologies to draw similar conclusions regarding the primary role of disparity-induced vergence in controlling intermittent exodeviations.[14-16] This fusional mechanism bears similarities to that in infantile nystagmus, wherein it is advised that any hyperopia be maximally corrected because it is only fusional convergence that damps the distance nystagmus.[17]

One implication of this "inverted" sensorimotor control mechanism is that the therapeutic use of over-minus lenses in intermittent exotropia could actually serve to *eliminate blur* that is secondary to the excess accommodation resulting from disparity-driven convergence and thereby *promote fusional convergence* at near. This mechanism is radically different from the accepted rationale for treating intermittent exotropia with over-minus lenses, which is to increase blur and force accommodative convergence to focus the visual image. Whether both mechanisms are operative in the same or in different patients remains to be determined. It may be that stronger minus lenses (−2 D to −4 D) favor accommodative convergence in children who are equipped to meet additional accommodative demands, whereas weaker minus lenses (−1 D to −2 D) favor fusional convergence in children that are not.

Both convergence and accommodation are normally necessary for near vision but neither are necessary for distance vision. Yet even in individuals with normal vision, disparity drives convergence and it also drives accommodation (rather than vice versa).[11] However, patients with

intermittent exotropia need to converge at every distance, which drags along accommodation at those distances. So patients with intermittent exotropia at distance are in a dilemma—they can either converge to fuse but get blurred distance vision or allow divergence in the distance to leave things clear with relaxed accommodation. Because stereopsis is less important for distance, they are more likely to opt for the clear vision strabismus option (and panoramic vision, which some appear to prefer). Minus lenses therefore allow them to converge to control the exodeviation by correcting the over-accommodation so they can have both binocular vision *and* clear vision. On this basis, patients with intermittent exotropia may close one eye in part to eliminate the need for fusional convergence, enabling them to relax accommodation to the appropriate level for the distance. For near fixation, most normal individuals have an accommodative lag of at least half a diopter. In intermittent exotropia, the small lead produced by over-convergence may generate a degree of over-accommodation that similarly falls within the depth of focus or tolerable blur that everyone seems to accept.

If over-accommodation is indeed operative during periods of binocular alignment, one would expect several corollary clinical findings. First, one would expect patients with intermittent exotropia to experience diminished vision under binocular conditions. This symptom was recognized in 1945 by Burian,[18] and elaborated on in 1966 by Seaber.[19] A prospective study by Walsh and colleagues[20] documented decreased binocular vision and distance stereopsis in many patients with intermittent exotropia. Thus, although affected patients rarely complain of this symptom, careful examination shows that over-accommodation negatively affects vision during periods of binocular alignment. Second, one would also expect moderately hyperopic patients with intermittent exotropia to control their exodeviation better when given their full cycloplegic refractions. A study by Iacobucci and colleagues[21] found that

these patients often regain good control when given their full cycloplegic refraction, suggesting that fusional convergence is more powerful than accommodative convergence in controlling the deviation. Finally, we would expect that low to moderate levels of over-minusing would not induce a long-term myopic shift in patients with intermittent exotropia, an outcome that has been confirmed in several studies.[7,21] Furthermore, a recent 6-year-long prospective study found no change in myopic shift in children aged 7-12 years who underwent successful bilateral lateral rectus muscle recession.[22]

The therapeutic implication of these findings is that some patients with poorly controlled intermittent exotropia may be rescued from strabismus surgery by small amounts of over-minus treatment to clear up vision and fortify binocular alignment. We may discover that we have been inadvertently under-minusing our patients with intermittent exotropia by not over-minusing them.

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