

Using evidence-based psychological approaches to accommodation anomalies

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ABSTRACT

Introduction: Accommodation anomalies are frequently caused or exacerbated by psychological problems such as anxiety. Patients share many features with those with other anxiety based somatic symptoms such as stomach-ache, palpitations and headaches. They can be difficult to treat, and the ophthalmic literature rarely goes beyond diagnosis and ocular treatment. This study reports characteristics and outcomes of a short case series of patients with accommodation spasms and weaknesses assessed objectively, and outlines a psychological approach to treatment

Methods: 23 patients (13 severe accommodative weakness or “paralysis,” 10 accommodative spasm) aged between 8–30 years, were referred to our laboratory after diagnosis by their referring clinician and exclusion of pathology or drug-related causes. Their accommodation and convergence were assessed objectively with a laboratory photorefractive method, as well as by conventional orthoptic testing and dynamic retinoscopy. All interactions with the patients used an evidence-based psychological approach, to give them insight into how stress and anxiety can cause or exacerbate eye symptoms and help them to break a vicious cycle of anxiety and risk of deterioration.

Results: 83% were female and 57% had previously diagnosed anxiety or dyslexia (with many more acknowledging being “worriers”). Inconsistency of responses was the rule and all showed normal responses at some time during their visit. Responses were poorly related to the visual stimuli presented and objective responses often differed from subjective. Dissociation between convergence and accommodation was more common, compared to our large, previously reported, control groups. No participant had true paralysis of accommodation. Responses often improved dramatically within one session after discussion and explanation of the strong relationship between anxiety and accommodative anomalies. None have returned for further advice or treatment.

Conclusions: Our approach explicitly addresses psychological factors in causing, or worsening, accommodation (and co-existing convergence) anomalies. Many of these patients do not realize that a certain amount of blur is normal in everyday life. Ocular symptoms are often a sign of anxiety, not the primary problem. By recognizing this, patients can be helped to address the triggering issues and symptoms often subside or resolve spontaneously. Well-meaning professionals, offering only ocular treatments, can deflect attention away from the real cause and can unwittingly be making things worse.

KEYWORDS

Accommodation paralysis; accommodation spasm; psychological; anxiety



Introduction

Accommodation anomalies can be challenging to treat. While some can be caused by pathology, many have a psychological component and can share features with other functional vision disorders.¹ Modern lifestyles, increasing use of small screens, high anxiety levels among young people and, most recently, COVID-related causes, anxiety and uncertainties,² are increasing the incidence of cases.³

Cycloplegics, reading glasses, prisms and orthoptic exercises can have limited success, and may even slowly exacerbate symptoms. Mild problems can become firmly entrenched and some patients may

seek multiple opinions over many years. Even if the psychological origin is acknowledged, the best way to help can be unclear, or difficult to access.

Orthoptics or vision therapy has been shown to be largely successful, as evidenced by standard textbooks,^{4–6} but some patients do not respond well to standard therapy. Even the most recent literature on accommodation anomalies generally still relies heavily on subjective findings^{7,8} and details of instruction-set and required effort are rarely reported in enough detail to be sure whether placebo, effort, instruction and expectation effects have been fully controlled. Even carefully designed

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study series⁹ may not sufficiently control for these effects, and the importance of placebo and nocebo effects^{10–12} and the importance of objective testing are only recently becoming acknowledged.¹³ The literature suggests quite prescriptive limits of “normality,”⁴ and until naturalistic, uninstructed responses started to be reported in infants and young children^{14,15} it was generally assumed that because pre-presbyopic people could accommodate, that they always *did*.

Our laboratory¹⁶ has been researching accommodation and convergence objectively since 1997. Our minimal-instruction method repeatedly shows that accommodation is not necessarily as good, consistent, or as strongly linked to convergence, as the literature commonly suggests. Typical, pre-presbyopic people rarely think about whether their vision is clear or not during daily activities and blur is rarely a primary, spontaneous problem. “Variable is normal” for some typical young adults and some blur is part of everyday life for most of us (for review see Horwood 2021¹⁷).

We are occasionally asked to objectively assess challenging cases of accommodation anomalies. The lab is in a large School of Psychology, which also hosts the Anxiety and Depression in Children and Young People (AnDY) Research Clinic,¹⁸ offering evidence-based psychological therapy for anxiety and depressive disorders in children and young people. Our informal conversations highlighted how functional, accommodative and convergence anomaly patients were very similar to the AnDY Clinic patients with other stress-related somatic symptoms (stomach-ache, palpitations, limb pains etc.). Since 2014 we have worked together to develop a psychological approach to help patients with accommodative anomalies at the earliest possible stage. This short paper presents a case series of affected children and young people^{13–18} and young adults, describing their ocular characteristics and the success of the psychological approach to explanations and support that we use.

Methods

Referring clinicians referred the patients for advice on refractory cases of accommodative and

convergence problems because of our expertise in the objective assessment of responses. Over time referrals have increased via word of mouth. Referrals to the lab were only accepted once neurological pathology or drug-related causes had been excluded by the referring clinicians. The patients were aware they were being assessed by a research expert in the field to help their referring clinician make better decisions. The protocol, recruitment and informed consent process complied with requirements from both the University and UK NHS Research Ethics Committees. All patients were tested wearing any distance correction required.

Immediately after the consent process, accommodation and convergence were assessed objectively by dynamic photorefractometry and vergence assessment at distances between 2 m and 25 cm using the standard objective photorefractometry protocol always used in the laboratory. For full details of the method see Horwood & Riddell.¹⁹ Initial instructions were minimal, but full explanations were given later. Targets presented eight different stimulus conditions which presented all possible combinations of blur, disparity and proximal cues to assess how accommodation and convergence responses relate to the complexity of the stimulus given. The advantage of this experimental method is that it is hard to work out what is being tested. Any occlusion is invisible, and the equipment is unfamiliar. Participants were asked just to watch the picture, with no instructions about effort or maintaining single vision or clarity. The closest testing distance was 25 cm, so extreme near points could not be assessed in this way. The explanation given to the patients was that we needed to repeat the whole set of measurements twice, and a clinical testing period in the middle of the session would give them a break.

In the clinical testing period, a case history was taken, concentrating on visual symptoms, and outcomes of previous treatment. No formal psychological assessment was made, but conversations about possible causes of stress, and their attitude to their symptoms, occurred throughout the investigation. Examples of questions to patients and parents might be “are you a bit of a worrier about things?” or “have you had any things going on at home or school that have

bothered you lately?.” Often a parent would smile knowingly or nod behind the child’s back and it would then lead to a further conversation about what sort of incidents had occurred, for example dyslexia, family or friendship issues.

An orthoptic investigation was carried out, including visual acuity, cover test, ocular motility, stereoacuity, and prism fusion range. Convergence and accommodation were assessed formally (RAF near point rule) but also informally by quickly introducing a novel target (a small smartphone image) at 10 cm without warning, watching pupil reactions. This often produces much better responses. Accommodation was also tested objectively using Nott dynamic retinoscopy to a non-text detailed puzzle (a Where’s Wally search puzzle), and then text, on a smartphone screen with both eyes open. We specifically did not explain what the test was looking for, saying the retinoscope streak was assessing pupil reactions.

The patient was then given a break while the lab data were scored and plotted. Results were then shared with the patient (and their parents if under 18 years of age). Any normal responses found at any time were explicitly demonstrated on screen as proof that the physical processes of accommodation and convergence could be achieved, even if they were relatively rare. The laboratory procedure was then repeated, with additional encouragement if the first testing had shown fluctuating responses. Many patients showed entirely normal responses on the first attempt, so no further effort was necessary. A friendly, confident, sympathetic and positive approach was used throughout, emphasizing how common accommodative problems are.

Psychological approach

We developed a psychological approach and an information sheet to deal with anxiety-based visual symptoms²⁰ to help our patients. It was generally given at the end of the consultation. It is based on explanations of how stress and anxiety can exacerbate mild physical symptoms and how well-meaning professionals often make situations worse. By careful explanation and reassurance (using a cognitive behavioral approach), patients and parents are helped to realize that their visual symptoms can be

a *signal* of stress, and not always the primary problem. This approach may well help or cure the visual symptoms and break a spiral of deterioration. The patients can then be encouraged to address the triggering stress and anxiety and be signposted to other help as appropriate (via trusted organizations, e.g. Young Minds²¹). This can be low-level, such as family or educational understanding and support, self-help materials¹⁸; or evidence-based treatment for anxiety difficulties (i.e., cognitive behavior therapy (CBT)²² delivered by trained professionals.²³ The approach is as follows:

The downward spiral

- The patient has a mild issue that makes someone suggest an eye test might be necessary e.g., school difficulties, literacy issues or dyslexia, concentration problems, headaches, viral illness, mild head injury.
- The primary professional, often an optometrist, naturally asks about blur and diplopia, because it is their job to do so.
- The patient then starts to pay attention to it. Accommodation is largely an automatic process – few people know *how* they accommodate, or even that it is occurring, but thinking about it and trying too hard may lead to inappropriate responses.
- On the return consultation, as requested, they report any blur they have noticed. It is very easy for this to be *medicalized* into a “a problem.” They (and their parents) are asked to note even more closely when it happens, and the individual may be offered treatment such as glasses or exercises if there is any mild ocular motility or accommodative defect, e.g., a small heterophoria. It is worth noting that anxiety tends to run in families and so children prone to anxiety may have anxious parents, who may be particularly attentive to the perceived problem.²⁴
- However, focusing attention on the problem may inadvertently make it worse as the individual starts to notice more and more things that seem to fit with the idea of this being a medical problem.
- In addition, the individual may undertake “*safety seeking behaviors*”²⁵ aimed at providing

reassurance, but actually leading to greater anxiety. For example, searching the internet for “blurred vision” or frequent checking that things are clear (when normally they would not have noticed if they were blurred). This may lead to more disturbed vision as they make inappropriate conscious efforts to accommodate. This then provokes more anxiety, creating a vicious cycle.

- If eye treatments do help, it is still not clear whether it is the exercises or glasses themselves, or just placebo or encouragement effects.²⁶ But sometimes they do *not* help and may even exacerbate the problem as they encourage more checking and anxiety, while reinforcing under-accommodation. Saying “tell me when it goes blurred,” as opposed to “try to keep it clear as long as you can,” implies that the tester wants them to look for blur as soon as it happens.
- The “bad eyesight” may become a way to explain away other problems such as difficulties at school or social pressures. It can then become the primary problem in the patient’s, parent’s and clinician’s minds, masking the real issue.
- Keeping accommodation and convergence relaxed, or conversely, excessive effort, every time close work is attempted may result in medium-term changes to tonic accommodation and further exacerbate visual symptoms.
- The patient (and parents) then starts *catastrophising*. “What if I can’t do my schoolwork/job/exams?”
- Because eye treatment may not help, or even encourage more attention on visual symptoms, patients may seek multiple, also ineffective, opinions and treatments, which reinforce the symptoms and divert attention away from the real issue.
- Trust in professionals can be lost and problems can last for years, occupy different specialist practitioners, and cause a great deal of distress.

In most cases, the following simple measures can break this vicious cycle in the early stages, and the symptoms subside.

The psychological upslope

- Exclude genuine ocular or neurological pathology and medication-related causes. Large heterophorias may mean that more conventional strabismus treatment is also necessary and may make it difficult to tease out physical from psychological issues.
- Try to establish if blur was the primary problem before seeking the very first consultation – it often was not. A first question is often “can you remember what took you to the optician in the first place?”
- Explain that blur is a normal part of everyday life and that trying too hard can make things worse. Everybody experiences some blur every day, but most people rarely pay attention to it, or mention it. Searching for “is blurred vision normal?” on a search engine, clearly suggests it is *not*. Explaining what is normal is important.
- Try to normalize the symptoms and adopt a confident, reassuring attitude that the patient has a common problem, that you understand it, and it nearly always get better. The aim is to allow them to stop thinking about their eyes. Show how even minimal convergence or accommodation responses you find prove integrity of physical systems but explain that they have got into a habit of accommodating inappropriately and it has stopped being automatic. If a child can play on a smartphone, there is probably little seriously wrong with their accommodation.
- Explain that constant checking of symptoms is likely to be counterproductive. Explain how easily the above “downslope” can occur and, importantly, encourage parents to stop asking for updates about symptoms.
- Avoid suggestions of malingering or “making symptoms up.” The symptoms are genuine, and clearly distressing, but discuss how common it is for physical symptoms to have a stress-related basis, and give other examples e.g., stomach-ache, nausea, headaches, dizziness and palpitations.

- Gently explore any sources of stress or anxiety – family, work or school stresses, social (or social media) pressures, divorce, bereavement, dyslexia, bullying. Parents are usually very quick to identify and acknowledge problems, and “read between the lines” about the direction of questioning. They are usually well aware that their child is prone to anxiety. Try to reassure everyone that anxiety is an understandable response and may help explain the nature of their current difficulties. If any safeguarding/risk issues are identified or suspected, these must be addressed following local procedures.
- Once stress or anxiety is accepted as at least part of the problem, it is possible to incorporate it into the management by changing the emphasis. The eye symptoms may be a *reflection* of stress or anxiety, just as much or more than a primary problem. Periods of bad symptoms may *signal* anxiety, so address the anxiety, not the eyes. Encourage the individual to try to identify triggers and explore/try out techniques to manage stress and anxiety. This may include taking a break, going for a walk, connecting with friends, reducing social media and trying to deal with and face fears rather than using avoidance as a strategy. Going and playing on a small screen during the break is probably not such a good idea though! If anxiety difficulties are associated with distress and interfere in the person’s daily functioning then evidence-based treatment (i.e., CBT) may be warranted. There are many self-help resources available online e.g. those provided by the AnDY Clinic¹⁸ or Young Minds.²¹
- Convergence exercises will help accommodation²⁶ so are an active therapy to help normal accommodation without making it the primary focus of the exercise. Our policy is to try to avoid orthoptic exercises if possible, but if necessary we offer simple pencil push ups and rapid “jump” convergence between near and distance, but do not stress accommodation or clear vision *at all*, which can then return to being automatic and unconscious.
- Simple reading glasses may be necessary for specific tasks in the short term, but only as

necessary. They may take the pressure off accommodation and help avoid catastrophising about exams etc. but discard as soon as possible (to avoid them becoming a safety behavior or a crutch).

- Once accommodation is allowed to return to being an automatic response, symptoms frequently settle. Try to not offer another appointment, but explicitly give the option to come back at any time if they do not continue to improve.

Results

Twenty-three cases between 8 and 30 years of age were tested. For 70% of the participants it was a tertiary (or more) referral. None were receiving psychological treatment at the time of examination and the first author (tester) was not qualified to carry out a psychological assessment. Two children had had treatment in the past for general anxiety, which parents believed had been successful.

All the most severe cases (accommodative “paralysis” or persistent spasm) were in their late teens or young adults and had been tertiary referrals. Thirteen had weakness of accommodation (symptomatic inertia, insufficiency, “paralysis”). Ten were referred for accommodative spasm. None had significant heterophorias greater than 4Δ for distant fixation. None had near exophoria greater than 16Δ , which was explicable by full relaxation of convergence in a typical older child or adult with a normal interpupillary distance, but without additional basic exophoria beyond relaxation to parallel visual axes.

Common to weaknesses and spasms was within- and between-individual variation (Figure 1). “Good responses” could be found with a minimal-cue target with few visual stimuli, but the same individual could fail to respond to a more naturalistic target. Overall, richer targets, especially binocular ones tended to produce better responses (Figure 1c), but beyond this, responses were rarely driven by the target characteristics as predictably as occurs with most typical participants in our lab. Although non-linear associations between convergence and accommodation can occur in

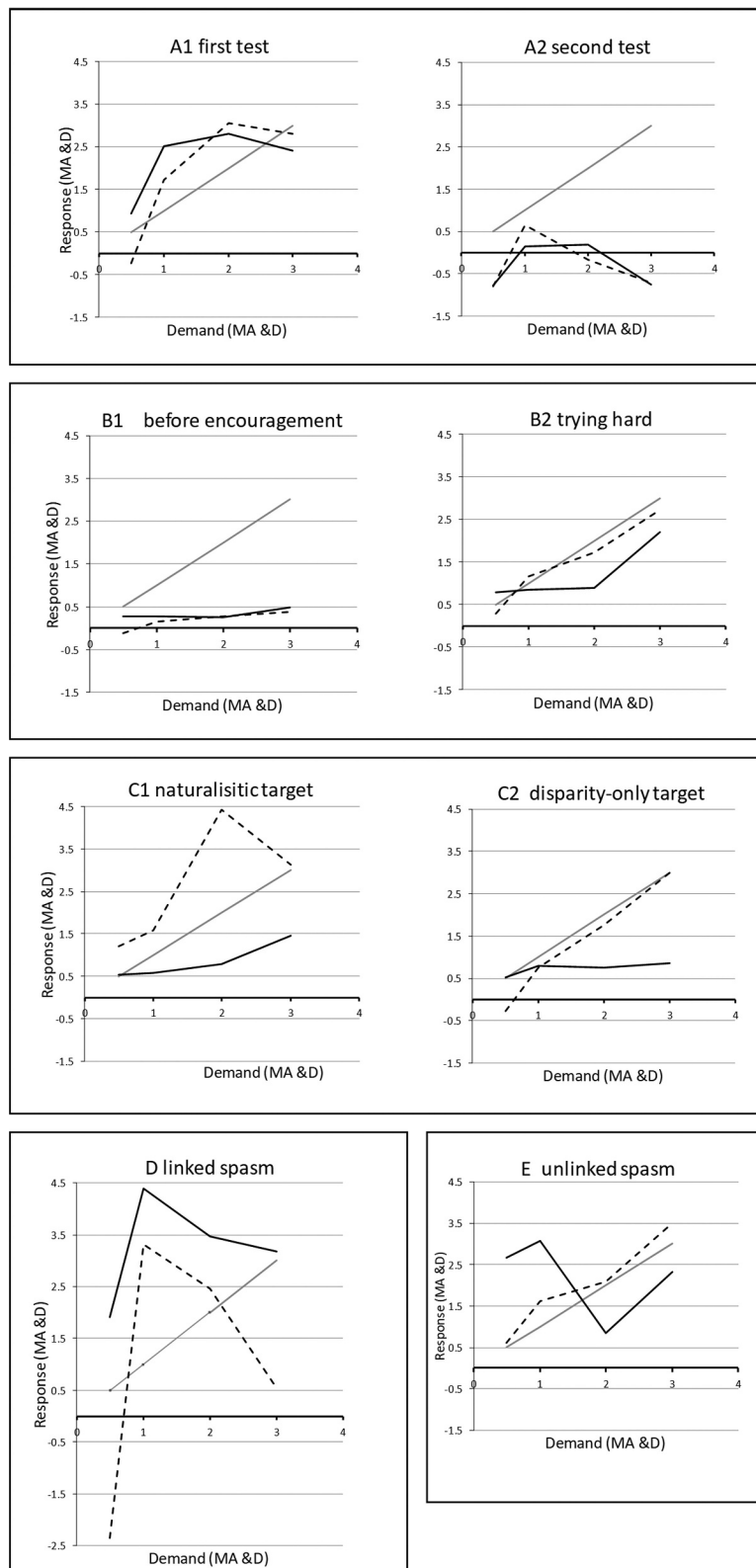


Figure 1. Simultaneous accommodation and convergence responses to targets between 33cm and 200 cm (0.5–3 diopter(d) and meter angle (MA) demand). Solid line: Accommodation in D, dashed line: Convergence in MA. Grey line: Perfect theoretical response. 1A1 and 1A2: Same patient, same naturalistic target 4 minutes apart. 1B1 and 1B2: Same patient before and after orthoptic investigation, demonstration and encouragement. 1C1 and 1C2: Same patient, different targets, excessive but erratic vergence and weak accommodation in C1 and normal vergence and weak accommodation in C2. D: Linked vergence and accommodation spasm for 100 cm target, but not for 33 cm or 200 cm target. E: Unlinked accommodation spasm at 50 cm and 100 cm, but normal vergence.

typical people, in these patients it was common, but unpredictable. Many had learned to converge without accommodating, or converge normally but with excessive accommodation (Figure 1e). Eleven (48%) had parallel anomalies of both convergence and accommodation; both weak, or excessive (Figure 1d), but only a very few showed excessive responses in one system with weak responses in the other, e.g. accommodative spasm and convergence insufficiency of vice versa (Figure 1C1).

Dynamic retinoscopy to text or a puzzle on a smartphone with both eyes open, when the patient was unaware of the purpose of the test, was typically normal or intermittently normal. Dyslexic children often failed to accommodate to text, while responses to a picture puzzle were normal.

We attempted to classify the objective responses according to conventional clinical classifications, but it quickly became clear that subjective responses and clinical diagnoses rarely agreed with our objective findings. Highly symptomatic patients often produced entirely normal objective responses to our novel task, while others showed responses that approximately agreed with their subjective reports. Using the sudden, unpredictable convergence to near point method nearly always produced much better responses than a push-up subjective method.

The most notable finding was that every patient produced inconsistent results, with a frequently poor linear relationship between convergence and accommodation. Subjective responses rarely compared well with our laboratory assessment, and when confronted with a test they had done before, e.g. prism fusion range or an RAF Near Point Rule, responses were often worse than our unfamiliar lab tasks. For this small and extremely variable group, statistical analysis was not possible

Accommodative weaknesses (n = 13)

Eleven (85%) were female. Four (30%) had been previously diagnosed as “accommodative paralysis.” Eight (61%) had associated convergence insufficiency, often severe, and three (23%) had been

diagnosed with apparent paralysis of both accommodation and convergence. Six (46%) had symptoms precipitated by a minor head injury or health concern. Five (38%) reported diagnosed stress, anxiety or dyslexia, and most appeared somewhat anxious during conversations. Four (30%) had become reliant on reading additions and prisms for close work.

No participant showed true accommodative paralysis, although most showed erratic and poor responses at some time (Figure 1). The default pattern was to keep accommodation (and sometimes convergence) relaxed, but when distracted or becoming familiar with the task, they would briefly respond normally. Many failed to accommodate on one occasion, but then relatively normally for the same target a few minutes later (Figure 1A1 and A2). Two severe “paralysis” cases only showed momentary and weak responses, but sufficient to confirm the integrity of the accommodation and convergence pathways. One patient had gradually, over 10 years, become reliant on +3.00 reading glasses with 18ΔBI incorporated prisms, but after being shown responses which proved she could occasionally accommodate and converge, and given enthusiastic encouragement, could converge to 7 cm and read N5 text without glasses by the end of the visit (Figure 1B1 and B2). Three patients were advised to do very simple jump convergence exercises to reinforce neglected convergence.

Accommodative spasm (n = 10)

Eight (80%) were female. Seven (70%) patients showed an isolated accommodative spasm with normal convergence, while 3 (30%) also showed inconsistent convergence spasm. Accommodation spasm could be, or was not, associated with convergence spasm (Figure 1d,e). Five (50%) had already been suspected of functional issues. Eight (80%) had known stress, anxiety or dyslexia. None produced consistent excessive responses, but all showed accommodative spasm at times, sometimes exceeding the operating range of our equipment (over 7.00 D of accommodation). Spasms often reduced as testing progressed and the patients relaxed.

The lab's policy is one of "positive discharge." A further appointment is explicitly not offered, explaining that it could re-activate subsiding symptoms; but patients are told they can make contact and come back at any time if things do not settle. Of our 23 patients, only one has made further contact and that was not for another face-to-face appointment, but for a reminder of how to do the simple convergence exercises that had helped the first time. Correspondence from their referring clinicians suggest that the severest cases are continuing to improve without further treatment. Because of the positive discharge policy, we may not be aware of any who have needed further psychological help, although they were all given advice to ring us if they needed signposting to services.

Discussion

The literature on functional vision disorders may discuss nomenclature or diagnosis, but rarely addresses the best way to support these patients once the diagnosis is established and a psychological element identified. A recent paper by Raviskanthan et al suggests one approach using techniques in functional vision loss with adults similar to those for "breaking bad news."²¹ These patients described here differ from those with functional loss of vision because there is a genuine anomaly of accommodation or convergence, but there is still a mainly psychological origin. Unlike patient with functional loss of vision, they have not been "tricked" into producing normal responses, which can lead to a feeling they are being accused of malingering, but they might need to be sensitively helped to understand how their eyes might not be the main problem. The approach used here changes the emphasis to a more holistic approach (based on cognitive behavioral principles). There may have been a mild precipitating eye problem but worrying about it is a major part of the problem too, so treatment combines (a) simple eye approaches (low-key exercises and reading glasses only if really necessary) with (b) reassurance and increasing the patients' insight, (c) encouraging them to stop checking and other actions that may be inadvertently making the problem worse, and

(d) signposting to support if required. It is very likely that any exercises or glasses work with a large placebo effect.

Post-viral or post-concussion accommodation defects seem common and are widely reported,²⁷ but it is difficult to tell when any genuine pathological weakness recovers (with or without treatment) and the psychological element takes over, reinforced by medicalization, repeated questioning and attention from well-meaning people around them.

Our research suggests that "variable is normal," and the ability to dissociate convergence and accommodation seen in these patients seems to be an exaggeration of normal variation. It could be a learned behavior or reflect primary weak accommodation-convergence linkages. Many asymptomatic people have sub-optimal accommodation responses and are happy to operate with modest blur,¹⁷ but in the general population habitual intermittent blur this is so common it is rarely noticed by anybody, or discussed. What differentiates many of the patients here is that they have been encouraged to think unrealistically that any blur is abnormal.

Many of our spasm patients had been given trials of cycloplegia in the past, with little effect. Cycloplegia is often used as a therapy, on the basis that paralyzing accommodation will stop spasms by stopping accommodative convergence. Theoretically this seems unlikely in view of current theories that disparity is the primary drive to accommodation (for review see Horwood).²⁸ Paralyzing accommodation just makes accommodation hard, and as it wears off, it might even exacerbate symptoms as anxious patients try even harder as their accommodation gradually returns.

We have found this approach successful and acceptable, even for severe and refractory cases. For clinicians without our laboratory, dynamic retinoscopy is an important test to assess accommodation objectively, because results may differ dramatically from subjective responses. Many dyslexic children accommodate normally, until they are presented with difficult text. We are also very aware that we exploit a very strong placebo effect. We may not be able to cure the initial cause of stress, but at least we are not now adding to it. By giving patients (and their parents) insight into the

underlying ocular and psychological mechanisms working to produce their symptoms it is possible to break vicious cycles, signpost to appropriate support, and allow accommodation to return to being a subconscious mechanism.

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