Article • What's Next? Long-Term Improvements from ICS Therapy Using Rapid Alternation

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ABSTRACT

Background: The rationale for treatment of intermittent central suppression (ICS) is a concern in reading underachievement. Diagnostic techniques for ICS have been previously described, and a treatment study for ICS showed improvements in binocularity, symptoms, and reading scores. The next step is to look at long-term improvements with treatment of ICS with rapid alternation.

Methods: ICS-specific QOL questionnaires were sent to 50 post-therapy patients in a private optometric clinic who had exclusively or almost exclusively used rapid alternation to treat their ICS. Eighteen patients or their parents returned questionnaires. Using patient pre-therapy examination and later post-therapy re-examination records of patients with returned questionnaires, long-term retention of ICS improvements was analyzed, as well as long-term changes in QOL.

Results: Treatment reduced suppression periods, thereby increasing the amount of time during waking hours that these individuals are truly binocular. Those changes showed little degradation over a 2¼ year period. This was done with no intervening maintenance therapy.

Conclusion: QOL scores improved and remained improved over this two-and-a-quarter-year time period. Since the ICS was treated largely in isolation, and since the QOL changed for the better with this single-factor targeted therapy, we can say without hesitation that increased time through waking hours with true binocularity is beneficial. Further, if ICS is treated to increase binocularity, positive changes are retained over time. Loss of improvements is minimal. Treating ICS improves lives, and those improvements hold over time.

Keywords: binocularity, intermittent central suppression, quality of life, rapid alternation, rapid alternate occlusion, suppression

Introduction

Intermittent central suppression (ICS) has been a recognized diagnosis for decades.[1] The concern is underachievement in reading.[2] The method of diagnosis, no doubt, has changed over time, but it is still moderately well documented.[3,4] The lack of widespread recognition of ICS and its effects and the lack of active investigation of ICS has led to using "missing link" as a descriptor for ICS.[3] Although the language may seem unfair, in many ways, it accurately describes ICS, especially as it relates to binocularity problems affecting reading.

Classic strabismus-derived suppression tests (below) were shown to be low-yield in a population of intermittent suppressors, adding credibility to the term "missing link" for ICS and its diagnosis. Not only were these classic strabismus-derived suppression tests unprofitable as diagnostic tests for ICS when compared to a benchmark of routine testing and questioning with polarized examination targets, they were also unrelated to each other in diagnosing ICS; that is, they didn't even diagnose the same subset of suppressors. That does leave the door open to suggest that a combination of tests could be useful, just as grouped tests have been used in a research setting looking at amblyopia.[5] Unfortunately, similar work has not been done regarding diagnosis of ICS. An additional advantage to the documented vectographic testing is that ICS can be measured based on responses using various subtests in a routine examination sequence.[3,4]

If a doctor is actively looking for suppression when strabismus and amblyopia are not present, best practices would suggest that Wirt stereopsis, Worth 4-dot, and the 4-prism test should not be used.[3] On the other hand, if the doctor is merely trying to disprove a diagnosis as expeditiously as possible,

those tests should have some utility. Tests that get the doctor to a comfortable predetermination of no diagnosable vision problem as quickly as possible might be termed palliative for the doctor. That is, the doctor feels better, whether the patient is helped or not. In those doctor-palliative tests rest many misdiagnoses or non-diagnoses.

After settling on a valid method of diagnosis and a valid ICS diagnosis, the next step in considering the effects of ICS would be somehow to treat ICS, preferably as much in isolation as possible.[6] If a treatment can reasonably be shown or reasonably be assumed to treat this suppression, but not directly treat vergence, eye movements, or accommodation, the results of treatment should help confirm or deny reasons to diagnose and treat ICS. Further, if time can be excluded as a treatment variable, then continuing normal visual development might be excluded as a causative treatment variable. Through treatment, we should be able to see whether ICS causes problems for people, whether the ICS is treatable, and then whether a group of suspected symptoms and problems improves with treatment.

Therapy for ICS on a group of young adults with ICS at a Job Corps site provided that next step.[6] As young adults, development could be excluded as a major treatment factor. Treatment of the suppression with rapid alternation (5 Hz electronic rapid alternate occlusion using liquid crystal lenses) provided the targeted ICS therapy that excluded direct or targeted accommodative, vergence, and eye movement therapies as possible complicating factors in evaluating changes. The specific instrument consists of internet-acquired liquid crystal "glasses" attached to our prototype control unit set at a standardized bilateral direct 5 Hz square-wave alternation rate.[6] The protocol required reading or other near activity with visual detail wearing the rapid alternation glasses for 30 to 40 minutes.

If other therapies were involved, the question remains whether they were responsible for any changes. In this Job Corps study, there were no therapies specific to other visual functions. Were the changes placebo-related? The travel burden from the treatment site to the clinic, 2.5 hours by car in good weather, limited clinic visits, which limited doctor-patient interaction. Doctor-subject interaction can be a source of placebo. Placebo can never be entirely discounted but would probably be more likely had there been more frequent direct-contact visits. Many of the Job Corps students were seen at the beginning and the end of therapy and then were lost to follow-up.

With a geographically isolated, suppression-specific therapy on post-developmental adults, positive results were reported. First, suppression periods were reduced in length, and time periods between suppressions increased in length. That is, this group spent more of their waking hours with binocular vision; both eyes in a sustained-over-time fashion transmitting their central visual images intact to the cortex. Accompanying the changes in suppression were improved quality of life (QOL) scores, improved reading-specific QOL question scores, and improved reading scores on standardized testing. Those improvements happened over just under six months of therapy.

When positive (or negative) changes happen with any form of therapy, some effort is usually made to understand why, to attempt to explain these changes. The theoretical case for improvements in suppression with rapid alternation starts with the two components of more traditional anti-suppression therapies (excluding penalization therapies[7]): bilateral sight and visual motion. Stereoscope techniques such as tracings or colorings in the stereoscope illustrate those procedures, as do the Louis Jacques-described dissociation techniques; dissociate with enough vertical or lateral prism for diplopia, then watch moving targets, such as a rotators.[1] As vision is shifted from one target to the other every few rotations, the non-fixated target provides a peripheral motion stimulus to the eye seeing that non-fixated target.

What does that have to do with a rapidly alternating occlusive visual environment? We know, or strongly suspect from a variety of sources, that on/off flicker is a fairly strong, non-directional motion stimulus.[8] That motion stimulus selectively drives magnocellular neurons synapsing at the lateral geniculate nucleus (LGN). A fairly strong case can be made that ICS is a defect in that magnocellular pathway, decreasing its foundational role supporting sustained activity, and therefore sustained image detail in the parvocellular pathway. With a 20% drop in magnocellular activity, parvocellular activity drops out, and that is what we see as the suppression.[8] At 5 Hz alternation, temporal summation keeps each image "alive" for an additional 100 msec, and the on/off pace not only drives one side strongly against the other but also negates masking both before and after each open/on period. The result is a strong bilateral motion stimulus;[7] suppression decreases

and binocularity increases. As binocularity increases, fixation should become more accurate and more stable in sensation-transmission to the cortex.

What's next? ICS diagnosis has been defined by and refined using routine vectographic binocular examination at distance and at near. Data shows improvements in quality of life and reading levels through documented reduction in the suppression. In addition, a level of theory to explain the changes in binocularity as well as the positive changes in symptoms and reading behavior has been developed. The next step should be to look at retention of those symptom and binocularity improvements over time. Looking at long-term results should also, to some degree, answer the lingering question about placebo. Doctor-palliative effects of ineffective suppression testing may well continue in the professional life of an examining doctor sufficiently convinced of their testing efforts. However, significant time post-therapy should help separate the patient-palliative placebo effects of a doctor's attention from any actual therapy-produced quality-of-life changes and concurrent measurable changes in binocularity.

To that end, this clinical study looks at long-term results and retention of improvements from therapy for ICS. The vehicle to test sustained symptom improvement is a modified quality-of-life questionnaire. The result is a list of six QOL questions that might be used as an easy screener for ICS.

Methods

Quality of life as determined by pre- and post-therapy full COVD QOL checklists changed significantly with ICS treatment in a group of young adults.[6] Individual QOL questions on that checklist in that group also changed, some more significantly than others. Those individual questions will form the survey tool.

A post-therapy QOL checklist using those questions that individually changed significantly in the Job Corps study[6] was sent to 50 individuals or parents of prior patients as a retrospective inquiry. Those questions and their significance levels from the Job Corps study are seen in Table 1 and formed the retrospective QOL survey basis for this long-term study. Of the 50 sent, 18 were returned.

Patients or their parents were asked to reflect on these QOL symptoms that might have occurred prior to and potentially changed during the time in vision therapy. Further, they were asked how those symptom changes had held up in the two years since. The patient or parent was then to respond with a checkmark in one of four columns: Not applicable/no improvement, improved some, improved a lot, and improved but has gone back (reverted). Those were scored in the clinic as 0 for not applicable/no improvement, 1 for improved some, 2 for improved a lot, and if a symptom had reverted, that question scored -2. For the complete checklist, then, the range of possible scores went from +26 for everything improved greatly to -26 for everything went away. A score of zero would mean that the therapy had no effect. A positive average score from the group that averaged more than one standard deviation above zero would suggest that therapy for ICS, producing increased waking-hours binocularity, had sustained long-term benefits. No attempt was made to have pre- and post-therapy checklists to compare. Rather, the question asked was, now that you have been away from therapy for an extended period of time, how do you perceive changes from therapy, and have those changes lasted?

When surveys were returned, the clinic records were consulted to determine start/finish dates and the time from the end of therapy to the receipt of the survey. Ages at the start and end of therapy, the amount of time in therapy, and probable hours of

Table 1. 13 QOL Questions that Changed Significantly on an Individual Basis in the Job Corps Study

COVD QOL Questions	Job Corps Study Significance
3. Headaches with near work such as reading	<0.01
4. Words run together after reading	<0.01
5. Eyes burn/sting/water	<0.01
6. Fall asleep reading	<0.01
7. See worse/blurrier at the end of day	<0.001
8. Skips/repeats line when reading	<0.001
10. Tilts head or closes an eye when reading	<0.01
13. Omits or misses small words when reading	<0.01
14. Writes uphill/downhill	<0.01
16. Poor reading comprehension	<0.01
18. Holds reading too close	<0.01
19. Trouble keeping attention on reading	<0.01
20. Difficulty completing assignments on time	<0.01

usage of rapid alternation were calculated. Probable hours of usage were calculated from patient reports of usage in clinic records and should be looked at in that context: Patients, many of whom were children, reporting usage to staff or the examining doctor. All subjects had either a post-therapy sensory evaluation or annual vision examinations that provided long-term binocularity findings to compare with immediate post-therapy findings.

The same doctor did all of the evaluations as the only clinic doctor, so acuity measurements and suppression determinations are consistent. This doctor does an estimate of change in suppression behavior at each progress evaluation. That estimate examines various subtests in the routine ICS evaluation to come up with one number to help patients gauge progress. Clinically, that has proven useful to motivate patients. Although a level of inaccuracy or sloppiness is easily implied in a clinical estimate, expert opinion has been judged as "reasonable" in looking at symptoms.[9] The value of this judgment is that the estimates can be and were done over a period of years based on later routine post-therapy examinations performed on some patients. Therefore, if the doctor failed to do the original more rigorous timing of suppression behavior in later examinations, some reading on suppression behavior changes is still available in the records. None of those estimates was made in conjunction with this study; all were taken from patient records after annual or other follow-up examinations.

Space was also left on the survey form for comments. Three parents added a comment.

Mean, standard deviation, and 95% confidence intervals were calculated for the questionnaire results. As a follow-up, the six questions that changed most significantly in the current study were asked of a non-selected group of patients with new ICS diagnoses. The mean and confidence interval for those questions are reported in the appendix.

Subjects

All subjects were patients individually diagnosed and treated for ICS in a private clinic as private patients, and, as the study was retrospective, no patient recruitment was involved. Therapy specifically used 5 Hz rapid alternation (electronic rapid alternate occlusion) employing liquid crystal goggles. All patients had normal, healthy eye health evaluations at all examinations. Amblyopia and strabismus were excluding conditions, as was post-therapy concussion. Although some patients did minimal in-office therapy, which would include accommodative, vergence, and eye movement work, the vast majority of what would be called therapy for any vision, binocularity, or reading condition was rapid alternation, done at home, not in the clinic. Three patients did therapy in spaced segments due to other life and scheduling considerations. No maintenance therapy was done after finalization of treatment. Therapy with liquid crystal rapid alternation requires the patient to wear the goggles while alternating, with both eyes open, spending the therapy time doing something at near that has visual detail, such as reading, drawing, puzzles, or Legos. Prescribed use-time was from 60 to 120 minutes daily. Often, children managed 30 to 45 minutes. This standard clinical therapy protocol reflects prior published protocols with rapid alternation.[6,7]

Fifty questionnaires were sent to patients or parents of patients. The goal was explained in a cover letter that the data would be shared in a written paper, but that in no way would names be used. A return envelope was included, or the doctor's cell number could be used to text a photo of the completed checklist direct to the doctor.

Results and Discussion

The goal in this present study was to evaluate long-term benefits and sustained changes in patients after treating their intermittent central suppression. Long-term result studies have been done on similar vision issues but not on intermittent central suppression. Scanning a few easily-accessible long-term studies in the general arena of binocular vision shows a scatter of methodologies, in the number of participating institutions, in the number of research participants, and in the length of time from finish of therapy to reassessment. Six such studies are listed in Table 2.[10-15] Taking those six as possibly representative of similar studies in binocular vision, the average study is 4 years post-therapy, has 45 subjects, and involves 2.5 institutions that are some combination of hospitals and universities.

Different long-term studies show various aspects that limit how universally the results can be applied, as well as illustrating how difficult a long-term treatment study can be. For example, Levartovsky et al. evaluated occlusion therapy for amblyopia over 6+ years, but if visual acuity "deteriorated, occlusion of the good eye was reintroduced for as long as it took to restore vision to the level previously attained."[11]

Table 2. Easily Accessible Long-term Projects in the Area of Binocular Vision

Reference	Topic	N	Institutions	Years
Tejedor & Rodriguez, IOVS 2001	Esotropia/ botulinum toxin	68	1xH	4.8
Levartovsky et al., BrJo 1995	Amblyopia/ occlusion	94	1xH	6.4
Ohlsson et al., BrJo 1995	Amblyopia/ occlusion	25	1xH	10.4
CITT, Optom-VisSci 2009	Convergence insufficiency	70	9xU	1
Daniel et al., Frontiers/ IntegNeuro 2016	Convergence insufficiency	9	1xU 1xH	5 weeks
Alvarez et al., OptVisSci 2010	Convergence insufficiency	4	1xU	1
Average Project		45	2.5H/U	4

N=number of subjects, Under institutions: H=hospital, U=university. *The 5 weeks Daniel et al. refers to long term effects at the 5 week mark.

Similarly, the CITT study group had maintenance therapy for 6 months after completion of the initial convergence insufficiency therapy.[13] Tejedor et al. noted that residual esotropia was treated by repeating botulinum injections.[10] Nothing in this implies improper treatment, just some vagaries as to endpoints for actual active therapy.

Isolation to a single therapy shows similar limitations. CITT, for example, did accommodative and vergence therapies.[13] Again, that is not to imply incorrect procedure in taking care of patients (which, of course, is the only "true" determinant of procedure) just to note that convergence therapy was not done strictly in isolation. Alvarez et al. treated accommodative convergence with home therapy, but they isolated convergence to a greater extent with a computer paradigm office-based therapy. Perhaps due to the complexity and cost of the use of fMRI to analyze and to document brain activity changes with therapy, they had a treatment n of 4 and a long-term follow-up n of 3.[15] Daniel et al. treated accommodative convergence with a novel treatment device. Results look good for duration of reading fixation. However, long-term refers to long-term effects at the 5-week point.[14] These are not criticisms of treatment of patients, but illustrations of some of the difficulties with long-term, and many other, patient therapy studies.

Daniel et al. did make one very important statement: "To process visual information readily, fixation should be relatively stable with the eyes aligned to the same letter."[14] That statement closely echoes ICS theory as presented previously,[8,16] briefly discussed above as fixation becoming more accurate and more stable in sensation-transmission to the cortex. In those statements is the justification for this current study to look at sustained quality-of-life changes in a group treated for intermittent central suppression.

Eighteen (36%) questionnaire checklists were returned. The age of the group at the beginning of therapy was 10.5 ± 6 years, ranging from 5.25 years to almost 32 years. Average time since completion of therapy was 2.24 ± 1.36 years. The range was from 0.29 to 3.03 years.

Average acuity at the beginning of therapy was 20/25^{+} OD, OS. Refractive status at the start of therapy was about OU +0.25 (+0.27 OD, +0.26 OS) with no cylinder above 0.25 DC. The range of refractive status was from +1.00 to -1.25. The mode refractive status both pre- and post-therapy was +0.50 sph. Judging from the 20/25^{+} acuities, the modal refractive error, lack of strabismus, lack of amblyopia, and lack of pathology, this is a group that would pass most eye and vision screenings and many routine professional eye examinations. This does add some import to the possibility of a simple screening device for ICS that does not rely on acuity or refractive status.

Average post-therapy acuity was 20/20^{+} (20/18) OD, OS. With pre-therapy 20/25^{+} acuity and no strabismus or anisometropia to speak of, 20/20^{+} acuity post-therapy suggests some improvement in transmission of detail to the cortex. Four patients did show some myopic progression, changing the average refractive status post-therapy to OD plano, OS -0.07 DS.

On average, about 130 hours of therapy occurred over about 8 months. Those calculations are based on patient (often children) reports, so they might charitably be considered a high estimate of usage. Average age at completion of therapy was just over 11 years.

As was shown in the Job Corps study, rapid alternation as a treatment for the suppression of ICS is effective. In this current long-term study group, therapy decreased suppression periods by about three seconds from an average of 3.3 down to 0.4 seconds, timed during vectographic binocular evaluation with near targets, as previously described elsewhere.[4] This compares favorably with the reduction in suppression periods seen in the Job Corps study.[6] Bilateral sight/ binocular periods increased by just over 11 seconds,

from an average of 2.5 up to 13.4 seconds (for calculation purposes only, 20 seconds was chosen as the top limit time segment of binocular periods). Those final timings are combined with other findings to calculate the percentage estimate of suppression changes.

Not only is rapid alternation effective in reducing and eliminating ICS, but improvements hold well over time. A minimum of 7 subtests in the standard vectographic binocularity examination procedure[4] are factored into the suppression-change percentage. Those patients who had their suppressions extinguished and who gave no questionable responses on any subtests would have been rated as 100% change. Some patients might have unfortunately been left with some residual suppression that would then reduce that percentage from 100%. In this group of 18 suppressors, 8 showed no time-measurable suppression at the end of therapy. Four of those had a subtest response suggesting less than perfect binocularity, so they were rated less than 100%, two at 95% and two at 99%.

Post-therapy reexamination, often routine "annual" examinations for each subject, provided long-term information on sensory binocularity to evaluate alongside the patient- or parent-reported QOL changes. These examination findings suggest that some loss of ending binocularity gain from rapid alternation ICS therapy may be within expectations. Average improvement at the end of therapy was 94%, with the low end of the range at 75%. Based on these examinations, after ceasing therapy, that average percentage dropped to 91%, with the low end of the range again 75%. Three of the patients who improved 99% ticked up to 100%. The greatest loss was a patient whose suppression score dropped from 99% to 80%. Individual variation in those losses, of course, should be expected, as evidenced by the 19% loss above, but on average, loss of binocularity gains from rapid alternation for ICS should be less than 5% over two-plus years.

To add some context to the 19% loss (and by extension, to the other estimates of improvements in the ICS), when therapy was initially suggested for this patient, his suppression was timed at near[4] as 3-second suppression periods spaced by about 2 seconds of bilateral sight/binocular periods. Suppressions were also seen on the vectographic distance acuity chart in the left eye. When asked if the maximum stereo ring reported correctly "stays out all the time," he reported that the stereo ring at distance intermittently flattened. When therapy ceased, he showed very brief suppressions, much less than one-half second ("like a blink") in duration about every 10 seconds, with no stereo flattening. At that point, the improvement was rated as 99%. Two years later at his routine examination, his binocularity had deteriorated so that half-second suppressions occurred at intervals of 5 to over 10 seconds. So, originally, in a given 10-second period, maybe four seconds were spent as "binocular." After therapy, just less than 10 out of every 10 seconds were binocular. That then degenerated over two years to somewhere between less than one-half to perhaps one second suppressed; that is, perhaps slightly more than nine seconds out of ten were binocular versus the beginning-of-therapy four seconds and the end-of-therapy almost ten seconds. The rough clinical estimate of overall improvement, then, was 80% at the two-year point.

Switching from binocularity scores to the current study's QOL survey, similar long-term results are seen in the 2.25-year post-therapy QOL scores. On the scoring range for the questionnaire of -26 to +26, a positive score suggests that positive effects were retained over time. The average patient QOL score from the group was 8.7±4.7. This average scoring does not include zero within one standard deviation. The ninety-five percent confidence interval for group scoring is from 6.55 to 10.89, so this again does not include zero. Therefore, the therapy did have an effect, and that effect was positive. All QOL responses are 2.25 years (avg.) post-therapy. No individual question scored in negative numbers for the group. Since regression over the two-plus years was scored as a negative, even with the scoring weighted for negativity, regression was insignificant.

If instead of looking at average scores across 18 patients, we look at average scores across 13 QOL questions, we see the same picture. The average score across the 13 questions was 11.9±5.6 with the 95% confidence interval for the mean being 9.3 to 14.5. The mean is positive and different from zero; therefore, these symptoms changed with therapy, and remained changed. Table 3 shows the post-therapy QOL questions that had positive responses to change and the number of positive responses. All questions had some positive responses, so the entire list of QOL questions showed some change with therapy. This also suggests that this list of questions was linked to QOL changes coming from increasing binocularity through decreasing suppression using rapid alternation.

Table 3. Questions and Number of Positive Responses Showing Persistent Symptom Change

Did these change with therapy and have they remained improved?	Number of positive responses	Weighted for significance to ICS therapy changes
Headaches with near work such as reading	4	8
Words run together after reading	10	15
Eyes burn/sting/water	6	6
Fall asleep reading	1	1
See worse/blurrier at the end of day	7	11
Skips/repeats line when reading	13	19
Tilts head or closes an eye when reading	8	13
Omits or misses small words when reading	10	16
Writes uphill/downhill	8	13
Poor reading comprehension	12	21
Holds reading too close	5	8
Trouble keeping attention on reading	13	22
Difficulty completing assignments on time	8	17

The thirteen QOL questions returned from these 18 long-term patients had 106 individual question responses of change. No change/not applicable was, again, an option. Of those 106 individual question responses that were marked as changed with the therapy, five individual responses to single questions showed that the symptom reverted to pre-therapy, just under 5%. So, whether discussing changes in the ICS or changes in QOL improvements, less than 5% reversion is probably an acceptable expectation for therapy success over time.

Table 3 shows a weighted scale of change on QOL questions. Responses were weighted according to the scoring given by the respondent patients or parents in the returned questionnaires. That scoring was 1 point for improved some, 2 for improved a lot. Then, in an effort to further refine what changes in symptoms are made by reducing suppression and increasing binocularity, those five individual question responses that reverted were factored in, with one point given, since, initially, those symptoms must have improved. That weighted count in Table 3 has an average score of 13. Six questions scored above the mean. Those six QOL questions are bolded in Table 3 These six questions, then, form a core group of QOL questions that were started in the full COVD QOL checklist; were filtered through the first treatment study of ICS, the Job Corps study, as part of the most statistically significant QOL changes in that study; and were then sifted again for long-term changes from improved binocularity. Those six questions may form a screening tool for ICS. The appendix for this paper discusses a preliminary study of that idea.

Conclusions

Targeted treatment for ICS reduced suppression periods, thereby increasing the amount of time during waking hours that these people are truly binocular, and those changes showed little degradation over a 2.25-year period. This was done with no intervening maintenance therapy. Since QOL changed for the better with this single-factor targeted therapy, we can say without hesitation that sustained binocularity through the waking hours is beneficial. Further, if ICS is treated to increase binocularity, positive changes tend to stay over time. Loss of improvements is minimal. A follow-up to this paper, as well as the Job Corps study, will look at another means of evaluating ICS and changes with therapy: percentage of binocularity during waking hours. Treating ICS improves lives, and the improvements hold over time.

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Hussey E. What's next? Long-term improvements from ICS therapy using rapid alternation. Optom Vis Perf 2022;10(1):57-64.

Appendix

After determining the six questions that seemed to pertain with some specificity to the symptoms produced by ICS, when an ICS diagnosis was made, staff at the clinic were instructed to give those checklists to patients or parents prior to leaving the clinic to see whether newly-diagnosed ICS did actually share these symptoms with the long-term study cohort.

Twenty patients with new diagnoses of ICS (that is, new to the clinic and otherwise non-selected) did complete the checklist, with one extra checklist done by a parent whose child also completed a checklist. The average score of these ICS patients was 4.2±1.1 (95% CI 0.48, interval 3.78-4.75). This suggests that if used as a screening device, patients scoring 3 or more should be considered suspects for ICS. Since the 6-question questionnaire has not been validated across a broader population, broader use should be only with caution. However, as a screening tool in optometric offices not currently involved in therapy for binocularity, it may have some utility, perhaps prompting referral for therapy.