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ACCOMMODATION DEFICITS IN A GROUP OF YOUNG OFFENDERS*

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The enormity of the honour bestowed on the person invited to deliver the Patricia Lance Lecture is second only to the challenge that it represents in coming up with a paper worthy of the name. I am indeed honoured, and hope that what I have to say is of some practical significance and stimulus for further clinical research.

Patricia Lance for all age-groups of British orthoptists, has been synonymous with orthoptic training in Australia. She has been very active in the international world of orthoptics and ophthalmology, and host to several senior British orthoptists. I was delighted therefore in my early days in Melbourne to have the unequivocal support of Miss Lance. She was in fact one of the few to give me great confidence and inspiration in leading the school in the direction it has subsequently taken. For that I am most grateful. Miss Lance is a clinician, and an inspiration within Australian orthoptics — this annual lecture being a very suitable reminder of her eminence in the field.

The subject I have chosen to speak about has arisen as so much clinical research does, out of looking at multitudinous variables in other projects. In 1988 I was invited to screen a group of young offenders in a local remand youth training centre — the special education teachers believing that there may be some vision deficits. The bench-mark for vision defects for most people of course is the wearing of glasses, and the report was that no boys coming into the centre ever wore glasses. I anticipated of course, that there should be a number with refractive errors. There were, but what became much more obvious, was the number of boys with accommodative deficits with or without convergence insufficiency.

Before looking at the study itself, there are some comments of a general nature I would wish to make. These relate to our testing methods and the populations about whom we have normal data. After briefly reporting on the study, this will be further illustrated. Many of the functions that we assess clinically rely heavily on instrumentation, subjective responses, and something nebulous called clinical judgement. For the most part by good luck, these serve us well for the majority of patients, but still, there are always those difficult ones, and, depending upon our tolerance levels we label them with a diagnosis and a cause — often 'functional'.

However, our clinical judgement is more or less effective based upon the first 2 factors, that is, the reliability of the instrument and the results that it gives us. That part we should have complete and repeatable control over. In addi-

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tion to that, we must know whether the responses are normal or not for an individual, and in the case of a study, such as the one that I shall relate to you, whether the occurrence of a particular result across a sample population is normal or not. On review of a fairly wide range of literature on accommodation as with so many of the visual functions that we test, there is very little in the way of data from normal populations. There is much on pre-school and school-age children, but little beyond that. That is, from non-symptom or sign-producing visual function. It is therefore quite difficult to label aspects of visual function as normal or abnormal if the study does not have an age, and in this case, sex-matched group with which to compare.

ANATOMY OF ACCOMMODATION

In order to understand what is being tested, it is necessary to briefly look at what is known of the pathways for accommodation, and its relationship with the other aspects of the near reflex. The accommodative reflex is activated in the retina by a blurred image, chromatic aberration, and an awareness of proximity. The afferent pathway runs with the visual pathway to area 17 in the cortex, then relays to areas 19 and 22 — the visual association areas. The efferent pathway is via the cortico-tectal tract to the Edinger Westphal nucleus, from where the parasympathetic fibres travel as part of the IIIrd cranial nerve to the ciliary ganglion. After this the short ciliary nerves leave the ganglion entering the eye to supply the ciliary muscle. Whether or not there is a sympathetic supply in opposition is still the subject of some debate. Davson[1] supports the view that the action of the ciliary muscle is opposed purely by the elastic properties of the lens capsule and contents. However, more recent studies, notably Stephens,[2] reporting in 1985, shows sympathetic involvement. In his study, alpha and beta adrenergic stimulation was used in conjunction with measurement of the AC/A response in human subjects. The results indicate a dual autonomic innervation for accommodation.

If you consider the musculature of the ciliary muscle, it can be seen that it is the annular (or sphincter fibres), and the radial fibres which contract causing elongation of the muscle and therefore an increased accommodative state. The presence of the meridional fibres suggests an opposing system. The reason of course for revising the nervous systems involved particularly in this group, is because of the effects of certain ingested agents which stimulate or denervate the autonomic nervous system. Substances such as caffeine and alcohol, through to prescribed and non-prescribed drugs have some effect on the autonomic nervous system, and therefore our measures of autonomic nervous system function — in this case, accommodation.

METHOD

The subjects were all inmates of a remand and youth training centre for periods varying between one month to 3 years, some being repeat visitors. Because of the nature of the institution and their rights within it, the vision screen was on a voluntary basis. However, only one refused over the 6 months of the study — it seems that the attention provided during a vision screening often represented a relief of boredom or was preferable to an anti-smoking film! The sample was gained by my attendance on a regular day each week in one of 3 sections in the centre and as many as possible on that section at the time were screened. Testing took place in room-lighting conditions, without external light, usually in the medical room attached to the section. A number of tests of visual function were carried out which are not reported here, but included convergence and accommodation. The total number of boys seen was 75 between the ages of 13 and 22, with a mean age of 17.37 years. The majority in fact were 17-19 year olds. Accommodation and Convergence was measured using the RAF gauge in the normal manner. In the case of accommodation, the measure was taken subjectively from the point at which the print first became blurred. The suggested normal near point of both convergence and accommodation for this age is 8 cms, representing 12 dioptres of accommodation. I have in these results erred on the side of conservatism, and taken 12 cms or less to be defective in the absence of other data.

In this study, all subjects with defective accommodation had distance visual acuity of 6/6 or better and demonstrable binocular single vision.

RESULTS

Accommodation

Of the 75, 27 (36%) showed accommodation to 12 cms or less, representing 8D or less of available accommodation. Of those, 14 (18.5%) could accommodate to 20 cms or less, 5D or less of accommodation.

Convergence

Of the 75, 13 (17.3%) showed convergence of 12 cms or less. Of those 13, 9 (12%) showed accommodation to be more reduced than convergence, only 1 (1.3%) showed convergence to be less than accommodation, and 3 (4%) showed equal convergence and accommodation.

Symptoms

Whilst remembering that none of these subjects had complained previously about visual/ocular problems, on questioning prior to testing, 19 (70%) of the 27 with reduced accommodation complained of some symptoms often associated with reading and close work. Ten (77%) of the 13 with convergence insufficiency also complained of symptoms.

Drugs — Prescribed/Non-Prescribed

It became evident through voluntary admission that many of the subjects were using drugs — mainly non-prescribed drugs such as cocaine, marijuana, heroin, amphetamines, and Avil, in addition to alcohol and smoking. Many admitted to taking the whole lot or "anything I can get". It was impossible therefore to judge any dosage or frequency of drug use, so it was merely recorded that they did or did not use drugs, or as unknown.

Of the 27 with reduced accommodation, 17 (63%) reported drug abuse. This compared to only 16 (33.3%) reporting drug abuse out of the 48 with normal accommodation. Of the 60 with convergence better than 12 cms, 27 (45%) reported abuse of drugs, compared with 6 (46.1%) of those with reduced convergence of 12 cms or less, i.e. there is no significant difference between the drug users and non-drug users in the levels of convergence.

DISCUSSION AND CONCLUSIONS

First of all it must be emphasised that according to all accounts of what constitutes a normal measurement of accommodation and convergence, the levels used here have been very conservative. If the clinically accepted normal measurement of the near point of accommodation and convergence had been taken to be 8 cms then 46 (61%) of the subjects would be considered to have defective accommodation, and 19 (25%) to have defective convergence. The conclusions that can be drawn from this information in the absence of other data are several:

1. This age-group of males may have a higher than normal incidence of accommodative weakness.
2. The reported synkinesis between accommodation and convergence may very easily be dissociated — the subjects demonstrating a weakness of accommodation were far more frequent than those with defective convergence.
3. The use of non-prescribed drugs may significantly affect accommodation. The specific drugs and their effects on either the parasympathetic or a possible sympathetic innervation cannot be commented on from this data.
4. The possibility that accommodative disuse even in the young adolescent leads to a reduction in its function.
5. The RAF Rule as a measure of accommodation in particular may underestimate the actual capabilities.

There are several comments of a general nature to be made having conducted this survey into accommodation deficits. Firstly, our traditional clinical methods of measurement of accommodation either as a range with the RAF Rule, or amplitude with lenses, fall far short of giving us adequate information about its function. Neither method yields information about the reaction time, maintenance of accommodation, or its real relationship to convergence and the near reflex. This data shows a clear dis-

sociation between the two particularly when accommodation is defective. In addition, it to some extent, refutes the idea that in all subjects accommodation is the major stimulus for convergence. In other words, a disruption of accommodation does not necessarily lead to loss of convergence.

A review of the literature reveals the difficulties with accommodation measurement and certainly provides a strong indication that our techniques of measurement should be evaluated and changed. Firstly, our measurement techniques. Current clinical measures involve total subjectivity and a measurement of near point only, or the total dioptric accommodative power using lenses. As mentioned earlier, no account is taken of response time or maintenance levels.

Secondly, we must consider the influence of ingested substances on the autonomic nervous system and therefore accommodation, the influence of temperature, and diurnal variations.

When the literature is examined, it is easy to see that attempts have been made to increase the objectivity of accommodation measurement. A review of the literature shows a lack of response by orthoptic clinicians to research work done as early as 1937. Specific instruments were designed for experimental purposes to look at fluctuations in accommodation in normal subjects.[3,4] Since then of course, other accommodometers have been devised but there would be few in clinical practice. To the extent that our systems are outdated, we as clinicians are ignoring at least one section of visual function and continuing with unreliable methods. This is the first point I would like to make, that in our efforts to expand our own research, we must not make the fundamental error of separating research from clinical practice. The symbiosis between the two should be a productive one for patients. However, we should be a little quicker to respond to the research than from 1937 to 1989.

The mechanism of accommodation and its relationship to the near reflex is clearly complex. It is complex because its control is dominated by the autonomic nervous system which is highly sensitive to metabolic changes induced by agents produced within the body and by ingested substances. Autonomic ocular changes have been reported with such factors as facial skin temperature, caffeine and alcohol.[5] Similarly eye movement function has been reported to alter with known illegal drugs.[6] The point here I wish to make is that when we assess something as delicately controlled as accommodation, then there are obviously factors which need to be taken into consideration, not only in experiments, but in clinical practice.

Here lies the clinical dilemma. We see patients or clients in the clinic — not subjects! These are people with symptoms and possibly signs of visual or ocular dysfunction — they are individuals and each one demonstrates multitudinous variables. As clinicians our role is quite clearly to produce an accurate diagnosis and subsequently a management strategy which will relieve the symptoms or cure the signs. As we all know too, for some people, it may be quite acceptable to have reduced accommodation and convergence (if we know what is reduced that is), but those that come within the normal limits of our tests, and still complain of symptoms who are the problem. That is why our testing measures must be improved — it should not be based so heavily on clinical judgement. I am convinced that that is one powerful reason why some patients will move from one clinician to another across all professions until someone can resolve their problem.

In conclusion, to return to the study related here, on the basis of the available tests of accommodation, there was a large number demonstrating an accommodative deficit by the standards available. There was also a significant level of drug abuse amongst those with reduced accommodation. But my original problems remain — the lack of data for normal populations, and the inadequacies of our testing methods for accommodation. This function plays such an important role in so much of our work with squint in children, through to whiplash and pregnancy in adults, it is time to consider an improvement of our methods of measurement and subsequently our management strategies. Clearly this sort of data leads us on to further research with more clearly defined and

isolated variables. It has answered one question — that this group of young offenders does demonstrate a high level of accommodation difficulties, and clearly these boys are not high achievers academically, either for reasons of motivation or because of their symptomatic or asymptomatic visual conditions or both. Conversely a disuse of accommodation leads into the hermeneutic cycle where reading and close work produce discomfort so that a commitment to reading is lost and further disuse is the outcome.

One final point that I would wish to make is the alacrity with which authors blame reduced accommodation on so-called functional factors.[7] That is, family background, psychological disturbance, or any other factor which provides an excuse for the difficulties which are encountered in the diagnosis and management of accommodative changes. I am suggesting that our ignorance should be tested first before passing off real symptoms and signs to functional failure. Various researchers have attempted to devise objective methods of accommodation measurement by adaptations of refractometers. We should be evaluating these methods against our current clinical methods, in order to establish the best method of measurement. In addition, the paucity of normal data is an issue that we must attempt to rectify in order to understand and make statements about individuals and populations.

Meanwhile, the decisions about the boys in this study who were found to be accommodatively defective by current standards, were taken out of my hands by the sorts of events that are common in the prison environment and by referral through the medical officer to outside clinicians. The interesting points are that there were a significant number with defective accommodation and when that happened it did not correlate with the convergence response. Secondly, there seems to be a close relationship between the use of non-prescribed drugs and a reduction in accommodative capacity. One could hardly argue that this group had some disturbance in their home or environment, but far be it from an orthoptist to claim that psychological factors were the primary cause.

In this study I have simply presented some very basic results and anecdotal comments on one of our traditionally accepted clinical measures. It has in turn raised a number of questions relating to our fundamental knowledge of clinical events and interpretation of results because as clinicians we rarely if ever take an over-view of a normal population. It is also the case that we rarely, if ever, evaluate our clinical testing procedures which have been designed to substantiate diagnoses. I venture to suggest that there are times when we use those clinical measures to substantiate a clinical punt, instead of basing our diagnosis on sound measures. This is not intended to be a cynical view, it does however, lead me to believe that orthoptics as a profession in Australia is more fortunate than we yet fully understand, to have its educational base in the university system which is there to be exploited for applied research purposes. New ideas can be explored in conjunction with those in clinical practice so that research and clinical work is inextricably intertwined. The universities have access to a range of funds for this purpose — we as a profession must extract our rightful share.

I would like to thank the Orthoptic Association Council once again for inviting me to present this paper under such a prestigious name at the Annual Scientific Conference of the Association, and to once again pay tribute to Miss Patricia Lance. May I also take this opportunity to thank the organisers and wish them luck for a successful conference.

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