

# The incidence and significance of low visual acuity in a prison population

**T**he aim of this research project was to confirm or otherwise the anecdotal experience of one of the authors (BRA), that ex-convicts appeared to manifest a disproportional amount of low visual acuity.

The objectives of custodial sentencing are various. It can act as a deterrent and punishment, serve to protect society and most importantly rehabilitate offenders. The prison population in England and Wales is approximately 75,000 and, as in the USA, has increased significantly over the last decade<sup>1</sup>. A typical offender is likely to be male (84%) and White, as show in Table 1<sup>2</sup>. In England and Wales, the ratio of prisoners per 100,000 of the population is 125, which is the second highest in Europe and second only to Portugal. However, Russia and the US have the highest offender to population ratio in the world and some six times higher than Western Europe<sup>1</sup>.

Important risk factors for offending include low attainment, poor family supervision, delinquent peers, low family income and large family sizes. Persistent offenders are typically from inner cities; low social classes, drug misusers and are often poor achievers<sup>1-5</sup>. It is probable that many prisoners are from a deprived background and are unlikely to have benefited from high quality childhood welfare, including preventative eyecare.

The average refractive error in the first year of life is between +0.60 and +2.62 dioptres<sup>6</sup>. If the initial refraction was below +2.50 dioptres, then typically the hypermetropia reduces to about +1.0 dioptres at aged six<sup>7</sup>. Hereditary, high degrees of hypermetropia, anisometropia, astigmatism and amblyopia are all significant risk factors in convergent squint, which typically develops between two and four years of age<sup>8</sup>. Prophylactic measures may include the early correction of hypermetropia between +2.00 and +2.75 dioptres in the less hypermetropic eye<sup>9,10</sup>. Additionally, anisometropia of one dioptre or more which accompanies hypermetropia greater than +2.00 dioptres and astigmatism of +1.00 to 2.00 dioptres which persists beyond the first year of life<sup>8,11</sup>

» Table 1

Ethnic distribution of prisoners in England and Wales<sup>1</sup>

|                      | White | Black | Asian | Other |
|----------------------|-------|-------|-------|-------|
| General population % | 94.7  | 1.75  | 2.60  | 1.15  |
| Prison population %  | 85.45 | 11.0  | 1.95  | 2.60  |

should also be corrected, together with appropriate orthoptic and surgical treatment.

Potentially 1-5% of the population may develop a squint, especially in the presence of the previously mentioned risk factors<sup>12,13</sup>. Eyecare practitioners are, of course, mindful of the needs for the early detection and correction of refractive and other ocular anomalies in children; ideally by a free or subsidised eye examination. However, the current system of pre and school medicals is at the best cursory, and is likely to mainly only detect the more gross defects, such as higher degrees of hypermetropia and astigmatism in addition to myopia. It follows that lower amounts of hypermetropia and astigmatism, which are both potential risk factors in the development of squint and amblyopia, are more likely to be undetected in childhood. It is suggested that preventative eyecare is

less likely to occur in children from a deprived background who, in turn, are more at risk of turning to crime<sup>13,14</sup>.

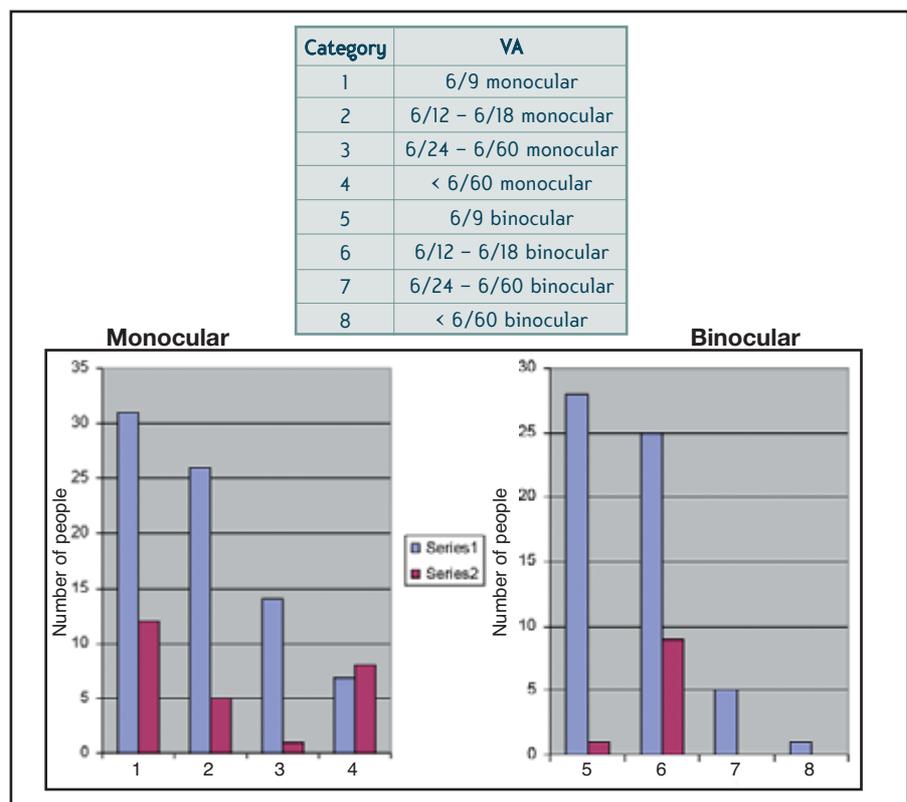
## Methods

For the purpose of this study, ametropia is defined as a spherical, spherical equivalent or meridional error of half a dioptre or more. Furthermore, a corrected distance vision of 6/9 or worse is considered synonymous with reduced visual acuity (VA), low visual acuity or amblyopia. In order to quantify, analyse and compare VAs, the refractive records of 418 inmates from five prisons were compared to 315 age and gender controlled patients seen in general practice by one of the authors (BRA).

Approximately one third of the prisoners recorded a VA of 6/9 or less in one or both eyes compared to 11.4% in the control group. Figure 1 compares the number of subjects with deficient vision in the two groups together with their respective VAs. In the prison group of deficient VAs, there were 24 hyperopes, 14 myopes and 56 astigmats. Myopia has been linked with higher intelligence<sup>15-18</sup>, and it is

» Figure 1

Comparison of VA in the prisoners (series 1 blue) and control (series 2 purple) groups



perhaps noteworthy there were five times as many myopes in the control as in the prisoner group (17.5% : 3.3%). Astigmatism is a likely contributory factor for reduced VA<sup>19</sup> and as illustrated in Table 2, 60% of those with reduced VA were astigmats. If left uncorrected, childhood astigmatism may result in meridional amblyopia<sup>20</sup> – a neural anomaly resulting in orientation dependent acuity loss.

In addition to the refractive defects, some 56 prisoners showed ocular disease and other anomalies, as illustrated in Table 3.

In comparing both groups, 32% of prisoners recorded a VA of 6/9 or worse in either one or both eyes, compared to 11.9% in the control group. This finding is both significant statistically ( $p < 0.001$ , Chi square 38.3) and it is also suggested clinically.

### Discussion

Whilst it has been established that a disproportionate number of prisoners in this survey manifest significant reductions in VA, the underlying causes are perhaps less apparent.

In a retrospective study, it is not always

possible to obtain full case history details, although some likely explanations of reduced acuity are outlined in Table 4. Pearce *et al*<sup>21</sup> stated that, “Only a small number (3.5%) were not prescribed spectacles compared to 40% in a university practice and 35 and 20% respectively in two small city private practices for comparable age groupings. Whatever the explanation, a great need for optometric services among inmates is apparent”. He also added that, “A very high percentage for whom glasses were prescribed at the time of their first examination in the prison clinic so that the typical new inmate does not avail himself of the benefit of optometric services prior to his prison sentence”.

It is the undetected hyperopes and astigmats who traditionally slip through the net at rudimentary school eye checks since they can, with only a brief accommodative effort, reach an acceptable standard on a Snellen or logMAR chart. However, they find close work especially tiring and frustrating and are unable to concentrate for long periods on studies. They become easily distracted, give up the effort and are more likely to become poor readers or even

illiterate<sup>14</sup>.

It is very often the socio-medically disadvantaged who have the added burden of being visually disadvantaged. Other than menial jobs, their chances of moving up the career ladder are minimal. There are multi-factorial reasons for criminal behaviour and this study has isolated just one factor, vision deficiency, which, because it may seem insignificant compared to other factors, has probably never been considered as a contributing cause of criminality.

Results of this study reveal a disproportionate number of the prison population with hypermetropia and astigmatism, especially hypermetropic astigmatism. Ideally, any vision check performed at school should include an objective refraction, such as retinoscopy, which although has never been part of the examination, is absolutely essential in detecting those who are hypermetropic /astigmatic. In other words, this would detect those who need some form of vision correction which could prevent, wherever possible, long-term visual disadvantages. However, the UK government is currently pressing for a reduction in the frequency of school sight tests to just a single one ( cursory and crude as it is but at least better than none at all), which makes for a depressing future as the visually disadvantaged will undoubtedly increase in number<sup>22,23</sup>.

Mutti *et al*<sup>14</sup> stated that, “Hypermetropia is a significant clinical concern in the visual care of children. Hypermetropia may impede learning and adversely affect academic performance. This may contribute to lower scores on reading and IQ tests (seen in some studies of hypermetropia)...Correcting hypermetropia reduces accommodative demand and improves accommodation accuracy”. Perhaps those “at risk” because of various socio-medical factors should have their eyes examined more frequently?

Ethnicity plays an insignificant role in the results. Although black prisoners constitute a disproportionate number of the prison population in the UK<sup>1,2</sup>, in this study about 85% of prisoners were Caucasian, about 10% Asian with the remainder being black and mixed race. The ethnic/racial make-up of the prison population was very similar to the control group.

A literature search revealed only two papers<sup>21,24</sup> comparing various visual parameters among the prison population and controls. No significant differences were found between the two groups apparent in the frequency distribution of attainable VAs, although Pearce *et al* did add a caveat to their findings: “The apparent lack of differences may reflect inadequacies of the comparisons to data not collected or presented in directly comparable manners”. The results in this

» Table 2

Classification of astigmatism in the prison population with low visual acuity

| Type   | Meridian              | n         |
|--|-----------------------|-----------|
| Plano  | Vertical & horizontal | 5 + _ *   |
|  | Oblique               | 5 + _ *   |
| Hypermetropic  | Vertical & horizontal | 24 + _ *  |
|  | Oblique               | 10 + _ *  |
| Myopic   | Vertical & horizontal | 6 + _ *   |
|  | Oblique               | 2 + 1/2 * |
| Mixed  | Vertical & horizontal | 1/2 _ *   |
|  | Oblique               | 1/2 _ *   |
| * _ indicates subjects with more than one type of astigmatism, e.g. one eye V & H, the other oblique |                       |           |

» Table 3

Aetiology of ocular disease and abnormalities in low visual acuity prisoners

| Trauma      | Pathology                    | Others                  |
|-------------|------------------------------|-------------------------|
| Cataracts 2 | Cataracts 2                  | Emmetropic amblyopes 26 |
| Others 2    | Maculopathies 2              | Strabismus 19           |
|             | Uveitis 1                    |                         |
|             | Insulin-dependant diabetes 2 |                         |

» Table 4

Some possible causes of prisoners’ VA deficits rarely known in this study

| Medical          | Ocular                                    | Socia-economical                      |
|------------------|---|---------------------------------------|
| In utero health  | Congenital defects                        | Parental neglect (medical and ocular) |
| Gestation period | Inherited defects                         | Domestic deprivation                  |
| Birth weight     | Details of first eye examination (if any) | Monetary problems                     |
| Nutritional      | Family history                            |                                       |

study are the complete opposite, i.e. there is a fundamental difference between the two groups in the frequency distribution of attainable VAs.

What should be mentioned here is that the author's (BRA's) observations, prior to this study, were of blue collar criminals and his supposition is that 'white collar' criminals would be unlikely to suffer from VA deficits and more likely be myopic<sup>15-18</sup>. Further studies should ideally include more information on the ocular and health histories in addition to the type and offence of the criminal, as outlined in Table 4.

### Conclusion

The prevalence of vision deficiency among the prison population is high. If vision deficiency is one reason, albeit one of many, for criminal behaviour, it could and should be minimised by frequent eye examinations in the formative years.

### Acknowledgements

The authors wish to acknowledge the invaluable assistance of Riyaz Jasat and Alan Young for access to their records regarding the refractive status of the inmates, and also to Dr Ivor Stiltz for statistical assistance.

### About the authors

Brian Ariel is an independent practitioner in North London. He opened the first sports vision practice in England, was founder member of the Sports Vision Association and has lectured widely on sports vision. Donald Loran is a semi-retired vision consultant. He is Past President of the then British Optical Association, Past Chairman of the Sports Vision Association. More details on this study are available by emailing [sports.vision@btinternet.com](mailto:sports.vision@btinternet.com).

### References

- White P (1999) The prison population in 1998. A statistical review. Home Office Research, Development & Statistics Directorate no 94, 1-4. [www.homeoffice.gov.uk/rds/pdf/r94.pdf](http://www.homeoffice.gov.uk/rds/pdf/r94.pdf)
- Muncle JM and McLaughlin E (2001) The problem of crime. Sage Publications, The Open University. National Association of Criminal Rehabilitation of Offenders (NACRO, 2004) Annual Report 20-23 and personal communication.
- Farrington DP (2003) What has been learned from self reports about criminal careers and the causes of offending? Report to Home Office. Institute of Criminology, University of Cambridge.
- Flood-Page C, Campbell S, Harrington V and Miller J (2000) Youth Crimes: findings from the 1998/99 Youth Lifestyles Survey. Home Office, London.
- Government Social Exclusion Report (2004).
- Goldschmidt E (1969) Refraction in the newborn. *Acta. Ophthalmol.* 45: 770.
- Ingram RA and Barr A (1979) Changes in refraction between the ages of 1-3. *Brit. J. Ophthalmol.* 63: 339-342.
- Mallett M (1988) Treatment and investigation of binocular vision. In: Optometry, Eds Edwards K and Llewellyn R. Butterworth Heinemann, Oxford.
- Ingram RA (1977) The problem of screening children for visual defects. *Brit. J. Ophthalmol.* 61: 8-15.
- Ingram RM, Wallace C, Wilson JM, Arnold PE, Lucas J, Dally SI (1986) Prediction of amblyopia and squint by means of refraction at age one year. *Brit. J. Ophthalmol.* 70: 12-15.
- Cobb CJ (2001) Strabismus and anisometropia. *Brit. J. Ophthalmol.* 80 (20): 1278-1281.
- Murthy G (1998) Paediatric child health. *J. Comm. Health* 3: 2612.
- Royal College of Ophthalmologists Annual Report (2002) Royal College of Ophthalmologists, London.
- Mutti DO, Haynes JR, Jones VA, Zadidk K, Kleinstein RN, Manny RE (2002) The CLEERO Study Group (2002). Accommodative lag in corrected and uncorrected hyperopia. *Optom. Vis. Sci.* 12; 5: 197.
- Mavracanas TA, Mandazos A, Peois D, Golias V, Megalou K, Gregoriadou A, Delidou K and Katsougiannopoulos B (2002) The prevalence of myopia in a sample of Greek students. *Acta. Ophthalmol. Scand.* 78 (6): 656-9.
- Miller EM (1992) On the correlation of myopia and intelligence. *Gen. Soc. Gen. Psychol. Monogr.* 118 (4): 361-383.
- Tay et al (1992) Myopia and educational attainment in 421,116 young Singaporean males. *Ann. Acad. Med. Singapore* 21 (6): 785-91.
- Storfer M (1999) Myopia, intelligence and the expanding neocortex. *Int. J. Neurosci.* (3-4): 153-276.
- Brown, SA, Weih LM, Fu CL, Dimitrov P, Taylor HR and McCarty CA (2000) The prevalence of amblyopia and associated refractive error in adult population in Victoria, Australia. *Ophthalm. Epidemiology* 7 (4): 249-258.
- Mohindra I (1975) A technique for infant vision examination. *Am. J. Optom. and Physiol. Opt.* 52: 867-870.
- Pearce RL, Rees DR and Hoffsetter HW (1972) Optometric data characteristics of male prison inmates. *J. Optom. & Arch. Am. Acad. Optom.* 49 (8): 661-672.
- Hall D and Ellman RH (2003) The Hall Report. Health For All Children. 4th Ed. Oxford University Press, Oxford.
- Thomson D (2002) A step backwards. *Optician* 223: 10-11.
- Hatch SW (1990) Visual acuity in the prison population. *Optom. Vis. Sci.* 67 (5): 382-384.