Preschool vision screening: results of a systematic review

NHS Centre for Reviews and Dissemination

Authors' objectives
To examine the effectiveness of preschool vision screening, to provide evidence on which decisions about the future provision of this service can be made, and to indicate areas where further research is needed.

Searching
The following sources were searched: Biological Abstracts, CINAHL, EMBASE, ERIC, IAC Health Periodicals, IAPV, MEDLINE, PsycLIT, the Science Citation Index, DHSS Data, Index to Scientific and Technical Proceedings (ISTP), SIGLE Dissertation Abstracts, Index to Theses, National Research Register, other databases of grey literature, and MSc theses from Departments of Community Paediatrics at UK universities. MEDLINE was searched from 1966 and all other databases from 1975. No language restrictions were applied. Additonal published and unpublished material was located by scanning reference lists, by contacting people working in the field, and by handsearching pertinent journals.

Study selection

Study designs of evaluations included in the review
Prospective controlled trials of treatments (with or without randomisation), for any of the target conditions were eligible for inclusion in the review.

Controlled trials, observational studies and audits of screening programmes for any of the target conditions were eligible for inclusion in the review.

Specific interventions included in the review
Studies evaluating treatment and screening for 3 target conditions: amblyopia, refractive errors, and squints which are not cosmetically obvious, were eligible for inclusion in the review.

Treatment interventions used in included studies were: CAM vision stimulator; conventional orthoptic treatment; levodopa or carbidopa; prism adaptation; occlusion; surgery or placebo.

Screening tests used in included studies were: appearance of eyes; head posture; cover test; ocular movements; convergence; 20D base out prism; stereotest (randot circles, Frisby, Lang, TNO, or Wirt Fly and pictures of animals); visual acuity (Sheridan-Gardiner opotypes, Snellen, letter matching, Kaye pictures, or Marquez-Bostrom’s hooks). Rerreferal criteria (i.e. positive screening test thresholds) used in included studies were: visual acuity (6/9 or less either eye, 6/12 or less either eye, 5/6 or less either eye, less than 6/6 either eye, greater than one line difference between eyes); eso/exophoria greater than 10D or 8D base out/in near/distance; abnormal response to prism; inward/outward deviation on cover test; manifest strabismus; nystagmus; heterotropia; abnormality of ocular muscle balance; convergence insufficiency 8cm or worse; abnormal appearance of eyes; facial asymmetry; abnormal head posture; ptosis; poor fusion or binocular vision; negative response to stereotest.

Reference standard test against which the new test was compared
No inclusion criteria were specified with respect to any reference standard test.

Participants included in the review
Studies of children aged 3 to 7 years treated for any of the target Conditions, and screening studies of children aged 3 to 4 years were eligible for inclusion in the review. Studies that focused on children with both severe disabilities and visual defects were excluded.

Outcomes assessed in the review
Studies using the following outcome measures were eligible for inclusion in the review:
Treatment: visual outcomes, visual complications associated with surgery, spectacle use, disability, patient perceived outcomes, and other side-effects.

Screening: uptake rates, referral rates, diagnostic yield, positive and negative predictive values (PPV and NPV, respectively), sensitivity, specificity, costs, visual outcomes, and patient perceived health outcomes. Outcome measures relating to diagnostic accuracy were calculated (in all primary studies identified) using retrospective analysis of hospital case records to determine the final diagnosis.

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for review, or how many of the reviewers performed the selection.

Assessment of study quality
Each study was critically appraised and methodological shortcomings were noted. The studies were critically appraised independently by the two authors.

Data extraction
The data were extracted by the first author and then checked by the second.

For treatment studies, data were extracted: on authors; study type and details of study design; sample size; intervention; visual or other outcomes.

For screening studies, data were extracted on: authors; screening tests and referral criteria; target condition; percentage referral from screened population; percentage yield of programme (prevalence of target condition); positive predictive value; false positive rate; other details.

Methods of synthesis
How were the studies combined?
Mean uptake rates and percentage referral rates were calculated from selected studies, considered to be comparable by the authors. A qualitative narrative was used to explore studies which were not considered suitable for quantitative synthesis.

How were differences between studies investigated?
Differences between the studies were discussed in the text.

Results of the review
Treatment: Five randomised controlled trials (468 participants) and 6 prospective controlled trials without randomisation (375 participants) were included in the review.

Screening: One prospective controlled trial and 16 retrospective studies (observational studies and audits) of different screening programmes (numbers of participants unclear) were included in the review.

Treatment: no clear evidence for the effectiveness of treatments for any of the three target conditions was found. Most of the studies were methodologically flawed. No studies were found which compared treatment with no treatment.

Screening programmes: orthoptic screening programmes perform better than health visitor (HV) or general practitioner (GP) screening in terms of yield and PPV. Mean uptake rate was 64.8%, and mean referral rate was 6.7% for primary orthoptic screening programmes and 3.9% for HV or GP screening. PPV ranged from 47.5 to 95.9% for orthoptic screening and 14.4 to 61.5% for HV or GP screening. Only two studies reported numbers of false negative cases. The one prospective study does not support the belief that identifying children with amblyopia in the preschool period reduces the prevalence of this condition in children aged seven.
Cost information
No studies were identified that were designed to evaluate the costs of screening. Estimates from observational studies and audits which included cost data were reported, suggesting that the cost of orthoptic screening is not great.

Authors' conclusions
There is a lack of good quality research into the natural history of the target conditions, the disabilities associated with them, and the efficacy of available treatments. In the absence of sound evidence that the target conditions sought in preschool vision screening programmes are disabling, and that the interventions available to correct them do more good than harm, the ethical basis for such interventions is very insecure.

CRD commentary
The review addressed a series of clearly described research questions, a proportion of which related to the effectiveness of preschool vision screening and the treatment of target conditions. The inclusion criteria used to select primary studies were broad but generally well described. The review of the accuracy of screening programmes, however, was notably lacking in any description of a 'gold standard' comparator test or method of diagnosis.

The search strategy was comprehensive and the review included unpublished data; it seems likely that all available data was identified. The review methodology was clearly reported and apparently rigorous and, although no formal method of assessing the validity of primary studies was used, studies were critically appraised and their methodological flaws discussed.

Given the apparent diversity of study designs and interventions included in the review, qualitative narrative summaries were appropriate. The validity of pooling uptake and referral rates to give means over several screening programmes seems questionable.

The authors' conclusions appear justified from the information presented.

Implications of the review for practice and research
The authors state that further research is needed in the following areas: the extent of disability attributable to the target conditions; the prevalence of blindness or partial sight attributable to amblyopia in the UK; the prognosis for vision in the amblyopic eye following loss of vision in the better eye; the impact of orthoptic treatment on family life and the psychological well-being of the child; the effectiveness of orthoptic treatment for amblyopia on vision and quality of life; and the effectiveness of treatment on noncosmetically obvious squints and refractive errors in this age group.

The authors make no specific recommendations for practice.

Bibliographic details

Original Paper URL
http://www.york.ac.uk/inst/crd/CRD__Reports/crdreport9.pdf

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Subject indexing assigned by CRD

MeSH
Child; Child, Preschool; Vision Disorders /diagnosis /epidemiology; Vision Screening; Vision Tests; Visual Acuity

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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.