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# THE EFFECT OF CLUSTER SEATING IN THE CLASSROOM ON VISUAL FUNCTION

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**Abstract**

*Cluster seating arrangements (where children sit in small groups facing each other) have been suggested to cause increased incidence of strabismus, particularly divergent deviations.*
*A study was undertaken to ascertain whether there is a difference in the incidence of strabismus in children seated in cluster seating arrangements, compared to those seated in a traditional manner.*
*Seventy-eight school children were tested. Thirty-seven sat in cluster seating arrangements, the remaining forty one did not. Results of orthoptic assessment did not support the concern that cluster seating caused an increase in the incidence of strabismus.*

**Key words:** *Incidence, strabismus, divergent deviation.*

## INTRODUCTION

Traditionally, classrooms were arranged with rows of desks and chairs, facing the front of the room and the blackboard. Modern teaching techniques suggest that children's learning is enhanced by participation in group work.[1] Seating in "clusters" facilitates this group participation.

In recent times the question, of whether seating arrangements in the classroom have an effect on ocular posture, has been debated. Individual professionals, such as optometrists and medical service nurses, have expressed their personal opinions to the authors, that "cluster seating", where children are seated facing each other rather than the front, may in fact be causing an increase in incidence of divergent deviations. It has actually been suggested that cluster seating has induced an "epidemic" of exophoria! Unfortunately, these concerns could not be substantiated or refuted with existing data.

In order to assess the validity of this claim, a sample of school children, normally seated in a traditional linear fashion were tested. The results of their visual acuity and ocular posture were compared to a sample of students who were normally seated in cluster formations. Our aim was to determine if there was a difference in incidence of strabismus or standard of visual acuity between these groups of children.

A survey of the incidence of defective vision and strabismus in children in their first year of formal education in Sydney, by Brown and Jones,[2] reported that of 5430 children, 3.5% had strabismus; the most common type being inter-

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mittent divergent squint. Just over half the children (55.8%), were found to have heterophoria, with exophoria for near being the most common type of deviation (36.4%). It is important to note that this sample was taken from children in their first year of infant school, therefore they should not have been exposed to either cluster seating or linear seating for any great length of time. Their study has clearly demonstrated the high prevalence of divergent deviations in a young school-aged population. The prevalence of strabismus reported in the Brown and Jones study is similar to that found by Macfarlane, Fitzgerald and Stark[3] and Friedman, Neumann, Hyams and Peleg.[4]

An extensive literature and Medline search found no data specifically relating classroom seating arrangements to ocular posture.

## METHOD

The authors were able to gain access to two State schools, located in one Departmental administrative region. The age, socio-economic and epidemiological characteristics of the populations were similar. They offered to provide adequate numbers of students who had been placed in the specified arrangements, according to the class teacher's preferences. The proposed study was presented to and approved by the Department of School Education.

Seventy-eight children were derived from these two State schools and were used as subjects. Two different classes were used from each school; one, where the children were seated linearly and facing the front of the room, and the other, where the teacher chose to use cluster formations. Children from Years 2, 3 and 4 were tested (their ages were not recorded, but assumed to be between 7 and 10 years old) and all children were able to read the letters on a Snellen's chart. In one school, the students were from a Year 2 and a Year 3 class, the other school provided students from a Year 4 and a Year 3/4 composite group to fit the linear/cluster seating criteria.

Testing was carried out at the end of the school year, so that any effects that seating arrangements may have caused would be maximised.

All students in the target classes were invited to participate in the study. Informed consent was sought from the parents/guardians of each child in a participating class before testing. All children who were permitted to be a part of the study and who were present on the day of testing, were included in the analysis.

The children were assessed in a manner in which the examiners were uninformed as to whether the child came from a cluster or linear class. The examiners were three orthoptists and one ophthalmologist on staff at the Children's Hospital, Camperdown, and all were present at both schools. All have considerable screening experience but cross examiner validity has not been specifically assessed. Details of previous ocular and family history were not requested in order to simplify the procedure and as we were most interested in population prevalence information. The children were questioned as to the use of spectacles, and where appropriate, these were worn during testing.

Testing at each school was conducted in a well illuminated, quiet environment where it was possible to set up standard testing conditions. Only those children who were currently being tested were in the room and supervised by an orthoptist.

Fixation was directed to a detailed target for near cover testing, 6/6 (or larger where necessary) letter for distance testing, and an object of interest, beyond 6 m, for far distance testing.

*Visual Assessment:* A standard orthoptic screening was performed on children in both groups. The children's pupils were not dilated.

The following were assessed:

- Monocular Visual Acuity at 6 m using a Snellen's chart.
- Cover Test at 1/3 m, 6 m and Far Distance.
- The Lang's Stereotest was used to assess binocularity.

The sequence of testing was randomised to avoid the influence of ordering and to speed the procedure.

## RESULTS

The null hypothesis that there is no difference in the incidence of deviation or standard of visual acuity between children seated in the cluster

TABLE 1
Visual Acuity

| | Seating Groups: Linear N=41 | Seating Groups: Cluster N=37 | Total N=78 |
|---|---|---|---|
| 6/6 or better both eyes | 80% (33) | 84% (31) | 82% (64) |
| 6/6 or less both eyes | 15% (6) | 8% (3) | 12% (9) |
| 6/6 or less one eye | 5% (2) | 8% (3) | 6% (5) |

classroom and those seated in the linear classroom was examined. A one-tailed chi-square test, with a significance level of 0.01, was appropriate for this analysis. (Critical chi-square [$\chi^2$ crit] = 5.41).

The results of both the cluster seating and linear seating groups were analysed and compared in terms of the presence and type of deviation for near, distance and far distance; and the level of visual acuity.

Children who were normally seated linearly accounted for 41 of the total subjects (18 boys, 23 girls). The remaining 37 were normally seated in cluster groups (16 boys, 21 girls).

*Visual Acuity*

A standard of 6/6 or better in both eyes was achieved in 33 (80%) of the linear seating group, and 31 (84%) of the cluster seating group (observed chi-square [$\chi^2$ obs.] = 0.10). The standard was less than 6/6 in each eye in six (15%) of the linear seating group and three (8%) of the cluster seating group ($\chi^2$ obs. = 2.08). The acuity was less than 6/6 in one eye only in two (5%) of the linear and three (8%) of the cluster seating groups ($\chi^2$ obs. = 1.7). See Table 1.

The null hypothesis was accepted in all cases, suggesting that there was no significant difference in the visual acuity of the two groups.

*Near Deviation*

There was a near exophoria in 16 (39%) of the linear seating group and 19 (51.3%) of the cluster seating group ($\chi^2$ obs. = 1.6). Six (14.5%) of the linear seating group were esophoric as were three (8.1%) of the cluster seating group ($\chi^2$ obs. = 2.08). Nineteen (46.5%) of the linear and 15 (40.5%) of the cluster seating group were orthophoric ($\chi^2$ obs. = 0.29). One child was found to have a vertical phoria combined with an esophoria. This child was part of the cluster seating group and as this was the single case, analysis was not appropriate. See Table 2.

Analysis did not reveal a significant difference in the prevalence of esophoria, exophoria or orthophoria between the two groups.

*Distance Deviation*

Cover testing for distance demonstrated orthophoria to be present in 35 (85.4%) of the linear and 30 (81.1%) of the cluster seating group ($\chi^2$ obs. = 0.10). Exophoria was revealed in five (12.2%) of the linear and five (13.5%) of the cluster seating group ($\chi^2$ obs. = 0.16). There was one case of esotropia in the linear seating group ($\chi^2$ obs. = 2) and the cluster seating group included one case each of esophoria ($\chi^2$ obs. = 3.25) and exotropia ($\chi^2$ obs. = 3.25). See Table 2.

Whilst there is some variation in the type and manifestation of detected deviations between the two groups, the size of the sample is inadequate to reveal any significant trend.

*Far Distance Deviation*

The incidence of orthophoria in the linear seating group was 35 (85.4%) and 33 (89.2%) in the cluster seating group ($\chi^2$ obs. = 0.01). Exophoria was found in five (12.2%) of the linear seating group and in three (8.1%) of the cluster group

TABLE 2
Deviations

| | | Seating Groups: Linear N=41 | Seating Groups: Cluster N=37 | Total N=78 |
|---|---|---|---|---|
| Near | Orth | 46.5% (19) | 40.5% (15) | 43.6% (34) |
| | Exo | 39.0% (16) | 51.4% (19) | 44.9% (35) |
| | Eso | 14.5% (6) | 8.1% (3) | 11.5% (9) |
| | XT | — (0) | — (0) | — (0) |
| | ET | — (0) | — (0) | — (0) |
| Dist | Orth | 85.4% (35) | 81.1% (30) | 83.3% (65) |
| | Exo | 12.2% (5) | 13.5% (5) | 12.8% (10) |
| | Eso | — (0) | 2.7% (1) | 1.3% (1) |
| | XT | — (0) | 2.7% (1) | 1.3% (1) |
| | ET | 2.4% (1) | — (0) | 1.3% (1) |
| Far Dist | Orth | 85.4% (35) | 89.2% (33) | 87.2% (68) |
| | Exo | 12.2% (5) | 8.1% (3) | 10.3% (8) |
| | Eso | — (0) | — (0) | — (0) |
| | XT | — (0) | 2.7% (1) | 1.3% (1) |
| | ET | 2.4% (1) | — (0) | 1.3% (1) |

($\chi^2$ obs. = 0.8). One student in the cluster seating group was found to have an exotropia ($\chi^2$ obs. = 5) and one student with an esotropia in the linear seating group ($\chi^2$ obs. = 2). See Table 2.

Again the differences in deviation between the groups failed to reach the significance level.

*Lang's Stereotest*

All children but one, reached the 550'' level. The exception was noted to have a small esophoria with left hyperphoria for near and distance with no movement recorded for far distance.

## DISCUSSION

The sample used in this study failed to demonstrate a significant difference in the ocular posture of children seated in clusters compared to children seated linearly. It is from this we conclude that seating arrangements have no adverse effect on a child's ocular posture.

In comparing the results of the current study to that of Brown and Jones,[2] we find that there are some variations in the prevalence of divergent, convergent and vertical deviations. These variations are possibly due to differences in population characteristics and sample size.

Cluster seating is a popular choice for most classroom settings. In fact, the authors had difficulty finding a linear classroom design, as earlier defined, being used.

Extensive searches through teaching and medical literature failed to find any definitive evaluation of the effects of cluster seating on ocular posture to substantiate concerns regarding an "epidemic", as related to the authors.

A claim that the positioning of children in the classroom could affect their ocular posture, is a serious one. If the claim could be proven, teaching methods would need to be revised. Left unproven, any uncalled for sensationalism should be stopped, as it causes panic and worry to carer's of children.

A teacher's main concern would have to be to provide children with the best opportunities for learning and incorporate this with all important social skills, aside from providing appropriate positioning in the classroom for children with visual impairment, visual field defects and ocular motility anomalies, it is apparent that most find cluster seating a useful tool for this.

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