Impact of visual impairment on balance and visual processing functions in students with special educational needs

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Abstract

Introduction

Vision is a critical factor for children’s development. However, prevalence of visual impairment (VI) is high in students with special educational needs (SEN). Other than vision disability, this group of students is prone to having functional deficits. It is unclear whether visual problems relate to these compromised functional deficits. This study aimed to assess the impact of vision on visual processing functions and balance performance in SEN students through a community service in special schools.

Methods

A total of 104 (age 14.3 ± 4.3 years, 43 girls) SEN students in Taiwan were assessed, who were classified as having normal vision (NV) or vision impairment (VI). Visual acuity (distance and near) and contrast sensitivity (CS) were measured as the visual outcomes. Visual processing function assessment included orientation recognition (mailbox game, MB) and facial expression recognition [Heidi expression test, in terms of card matching] (HC), and examiner’s facial expression matching (HF)]. Dynamic balance was assessed with Timed Up and Go (TUG) test, while static standing balance was assessed using a force plate to measure the postural sway in double-legged feet-together and tandem stance with eyes open and closed conditions. Static balance was presented in terms of the change in the centre of pressure in maximal medial-lateral (ML) and antero-posterior (AP) sways, sway variability (V), and sway path length (L).

Results

Although visual acuity was significantly worse in VI than NV (p < 0.001), CS was similar in the two groups (p = 0.08). MB, HC, and HF also did not differ significantly between groups (p > 0.05). NV performed better in the TUG than VI (p = 0.03). There was a significant interaction between eye condition and the vision group (p < 0.05) for static balance. Pairwise comparisons showed that NV swayed significantly less in ML than VI under tandem stance-open eye.
condition (p = 0.04), but significantly more in closed eye condition (p = 0.03). Conversely, VI had less V and shorter L than NV under tandem stance-close eye condition (p = 0.03).

Conclusion

This study is the first to our knowledge to examine the effect of vision on visual processing functions and balance performance in SEN students. Vision did not appear to be the major reason for impairment in visual processing. However, vision plays an important role in maintaining dynamic and static balance in SEN students.
Introduction

Vision in children is crucial for their daily life, as it contributes greatly to their development of functional abilities and essential skills needed for schooling and learning such as reading comprehension and mathematical concepts. However, visual disabilities are common in children with special education needs (SEN).\(^1\) Perinatal adversity is one of the major causes of vision loss,\(^2,\)\(^3\) including preterm birth, improper neonatal environment, and neurological damage, which can affect visual acuity, contrast sensitivity, and ocular alignment. The level of visual impairment has been shown to be dependent of the severity of the SEN (e.g. grading of cerebral palsy),\(^4\) which was partially attributable to cerebral visual impairment.\(^5\) In addition to neurological and anatomical damage, correctable refractive error is also highly prevalent in children with SEN,\(^6,\)\(^7\) so prescription of spectacles or other optical aids would be beneficial to improve their vision. However, current evidence shows inadequate eye care service for children with SEN,\(^8,\)\(^9\) leading to an inappropriate educational experience due to the misunderstanding of the individual’s visual status.

Balance function is also compromised in children with SEN, in terms of static and dynamic balance. Children with more severe cerebral palsy (higher gross motor function classification system level) recorded a greater magnitude of postural sway during a static balance measure than children with normal development,\(^10\) as well as dynamic balance function measured with the Timed Up and Go (TUG) test.\(^11\) Children with Down syndrome tended to spend more time to execute in functional balance tasks, such as performing a standing reach\(^12\) and the TUG test.\(^13\) The postural control system was also found to be underdeveloped in autistic\(^14\) and deaf children.\(^15\) For children with other intellectual disabilities, it was controversial whether their balance function was inferior to their peers with normal development.\(^16,\)\(^17\) However, visual impairment was associated with reduced balance function.\(^17,\)\(^18\) It was also reported that postural sway for male participants with visual impairment, regardless whether their eyes were open or closed, was similar to that of sighted participants with their eyes closed.\(^19\) This implies that vision has less impact on postural control despite compromised balance function in visually impaired patients. Balance function in children with mild disruption of binocular vision, due to strabismus or amblyopia, was significantly reduced.\(^20\) However, postural control was significantly improved after corrective surgery in children with strabismus,\(^21\) suggesting that
there is a possibility to improve balance function by correcting vision or improved visual
function. Children with visual impairment had poorer postural sway in both double-leg and
single-leg standing compared with their sighted peers. However, reduced static balance
function was only found in eye-open but not eye-closed condition. Both dynamic functional
balance and coordination were also reported to be weaker in children who were visually
impaired. Despite the important role of vision on balance function, no studies have
considered the impact of visual impairment in children who are more prone to have
compromised balance function (e.g. children with SEN).

In view of the importance of vision in childhood development, thorough assessment of visual
function and related visual processing function can provide information on the limitations of the
SEN children. Visuo-spatial and visuo-perceptual impairment, in terms of facial recognition
and line orientation judgement, are common in children with bilateral cerebral palsy and
autism. In contrast, adolescents who were born extremely pre-term or with extremely low
birth weight and visual processing disorders had poorer academic performance independent of
other perinatal diversities. However, based on the various capabilities of the SEN children, it
has been suggested that evaluation for visual processing function could be better delivered in
play situations, especially for children who functioned normally in other visual tasks such as
visual acuity. Despite the importance of vision on learning different perceptual skills, it is
unclear whether visual impairment further impairs visual processing performance in children
with SEN.

Previous studies have suggested poorer balance function, weaker visual processing function, and
higher prevalence of vision impairment in students with SEN. However, it is unclear whether
compromised vision further impairs these SEN students’ balance and visual processing
performance. To our knowledge, this is the first study aiming to investigate the impact of vision
on visual processing function and balance performance (dynamic and static) in students attending
special-care schools in Taiwan.

Methods

Study population
This study analysed the cross-sectional data collected as part of a community service project to provide eye care services for students with special needs attending ten special schools in Taiwan. All tests were conducted by optometrists and trained university students. A total of 157 students agreed to participate in the study, of whom 127 students had measurable visual acuity and at least one functional measurement. Students with solely visual impairment, but otherwise normal development (i.e. absence of other non-visual disabilities, n = 23) were excluded. The remaining 104 students (age 14.3 ± 4.3 years, range 4 – 19 years, 43 girls) were included in the analysis to assess the impact of vision on students with different disabilities, including cerebral palsy, autism, and Down syndrome. Written consent and verbal assent (if feasible) were obtained from the guardians and the students, respectively. All study procedures followed the tenets of the Declaration of Helsinki and were approved by The Hong Kong Polytechnic University Human Subjects Ethics Subcommittee.

Data collection
Demographics and information on the disabilities were obtained by a structured questionnaire completed by either the guardians or school teachers. The questionnaires included birth history, types of disabilities, self-report vision status, and visual problems.

Distance visual acuity was measured monocularly by Lea symbols at 3 m (or 1.5 m if vision was poor) using matching toys (The Good-Lite Company, USA). If the students were intellectually incapable of performing the test, tests with lower cognitive requirement were used, sequentially Cardiff acuity test at 1 m by pointing at the direction, Cardiff acuity test at 1 m by preferential looking, and Lea gratings at 57 cm by preferential looking. Habitual visual acuity of the better-seeing eye was converted into LogMAR acuity, allowing subjects to be classified into two groups: normal vision (NV, LogMAR < 0.50) and visual impairment (VI, LogMAR ≥ 0.50). Habitual visual acuity was used for grouping because the functional performances were assessed with visual correction aids. Near visual acuity was measured binocularly by LEA near vision card (The Good-Lite Company, USA). Binocular contrast sensitivity (CS) was measured using the letter version of Mars (The Mars Perceptrix Corp., US), or Lea low-contrast symbols flip-chart test / Hiding Heidi test (The Good-Lite Company, USA) at 40 cm if students were intellectually incapable, then LogCS was recorded. External and internal ocular health was
assessed using slit lamp biomicroscopy and direct ophthalmoscope (or binocular indirect ophthalmoscope with pupil dilation upon parent’s consent), respectively.

Visual processing function was evaluated by two paediatric tests (The Good-Lite Company, USA). Visual orientation recognition was measured using Lea mailbox game and the average time for five trials was recorded (MB). Facial expression recognition was measured using the Heidi expression test. The test was divided into two parts: (1) expression recognition with the Heidi cards matching (HC), (2) expression recognition with the examiner’s facial expression (HF). Both parts were timed and the average time needed for the five trials was recorded.

Dynamic balance function was measured by the Timed Up and Go (TUG) test. The students were asked to rise from a chair, walk three meters on a straight line, turn around, return to the chair, and sit down. The chair height depended on the height of the students using the common chairs provided by the schools, as the age of the sample covered a wide range. The test was repeated three times, with the time needed for each trial being averaged and recorded. Static balance function, in terms of postural sway, was measured using a force plate (BP400600, AMTI, US) with double-leg feet-together standing and tandem stance. Double-legged feet-together standing was chosen to mimic the natural standing position in daily life, while tandem stance condition was chosen over one-leg standing to mimic the postural stability during adverse conditions because of the limited capability of the SEN students in the current study. Postural sway was measured at each condition while standing steadily for 20 s under each of the four conditions: (1) feet together + eyes open (FO); (2) tandem stance + eyes open (TO); (3) feet together + eyes closed (FC), and (4) tandem stance + eye closed (TC). Students were asked to fixate at a distant target at 3 m under eye open condition (Figure 1). The force plate measured the subjects’ position at the centre of pressure (COP), at which several variables were generated and included in the analysis: maximum medial-lateral and antero-posterior sway (ML and AP – i.e. maximal amplitude of COP in the ML and AP dimensions), sway variability (V – i.e. variability of COP around its mean value computed by the root mean square of the COP displacement in ML and AP), and sway path length (L – i.e. total distance of COP travelled).
Figure 1. Measurement of postural sway while standing on a force platform for different conditions. Students were asked to fixate at a distant target at 3 m under open eye condition (left panel). Upper condition of the right panel was double-leg standing with feet together, while the lower condition was tandem stance.

Statistical analysis

As the distribution of some of the outcome variables was significantly different from normal, non-parametric tests were used in the analysis. Mann-Whitney U test was used to compare visual functions, visual processing functions, and dynamic balance function between the two groups. For static balance, the results were transformed to achieve normality using percentile ranking followed by inverse-normal transformation into normally distributed Z-scores. Two-way repeated measures ANOVA was used to analyse the main effects and the interaction effect between the grouping (NV and IV), eye conditions, and feet conditions on the static balance. Greenhouse-Geisser test was used whenever sphericity could not be assumed, and Bonferroni adjustment was used in the post-hoc comparisons. Inability to perform the test was regarded as missing data, which was treated with pairwise deletion. Significance level was set as p < 0.05. All statistical procedures were performed using SPSS v22 (IBM Inc, US).
Results

Among the 104 students, 62 (59.6%) were classified as having visual impairment (i.e. visual acuity of the better eye was $\geq 0.50$ LogMAR), in which the major causes of the reduced vision were optic nerve related (18.8%, including optic atrophy, optic nerve hypoplasia, and glaucoma), retinal impairment (17.6%, including retinopathy of prematurity, retinal dystrophy, and macular anomalies), uncorrected/under-corrected refractive error (14.1%), ocular media opacity (12.9%), and oculomotor anomaly (11.8%). However, a large proportion of VI (24.8%) was probably not due to ocular problems, but other neurological causes (e.g. cerebral visual impairment due to cerebral palsy). After subjective refraction or retinoscopy, 32 students (12 NV and 20 VI) were found to have uncorrected / under-corrected refractive errors and benefited from prescription of updated optical aids to improve their vision thereafter, with a mean improvement of visual acuity of LogMAR $0.33 \pm 0.17$. Twelve out of 20 VI students, who were prescribed with an updated optical aid, had best-corrected visual acuity better than LogMAR 0.50. Notably, among the 62 VI students, only 25 guardians/ teachers (40.3%) reported their children/ students having visual problems in the questionnaire, revealing an insufficient awareness of visual problems encountered in the special needs population. Given the different capabilities of the students, it was expected that some students could not complete all the tasks. The distribution of missing data in visual processing and balance functions were independent of the grouping ($p > 0.05$), indicating a similar capability in two groups.

The demographics, visual functions, visual processing functions, and balance performances of both groups of students are listed in Table 1. The age distribution was similar in the two groups ($p = 0.44$) and the LogCS did not differ significantly between VI and NV groups (Mann-Whitney $U = 886.00$, $p = 0.08$). VI and NV groups also had similar performances for the visual processing functions, in terms of MB, HC, and HF ($p > 0.05$). With respect to dynamic balance, NV students performed significantly better than VI students (Mann-Whitney $U = 1040.00$, $p = 0.03$), by a median difference of 3.61 s to complete the TUG task.
Table 1. Comparison of demographic, visual and functional performance between disability groups

| Demographic:                      | Normal vision (NV, n = 42) | Visual impairment (VI, n = 62) | p-value |
|-----------------------------------|----------------------------|--------------------------------|---------|
| Age (in years)                    | 16.0 (5.3)                 | 15.0 (5.0)                     | 0.32    |
| Gender                            |                            |                                | 0.88    |
| Female                            | 17 (40.5%)                 | 26 (41.9%)                     |         |
| Gestation age                      |                            |                                | 0.78    |
| Full-term (≥ 37 weeks)            | 28 (66.7%)                 | 42 (67.7%)                     |         |
| Pre-term (< 37 weeks)             | 6 (14.3%)                  | 11 (17.8%)                     |         |
| Unknown                           | 8 (19.0%)                  | 9 (14.5%)                      |         |
| Presence of self-reported non-visual disabilities (e.g. cerebral palsy, Down syndrome, autism) | | | 0.47 |
| (i) 1                             | 66.7 %                     | (i) 54.8 %                     |         |
| (ii) 2                            | 16.7 %                     | (ii) 21.0 %                    |         |
| (iii) 3+                          | 16.7 %                     | (iii) 24.2 %                   |         |
| Self-reported visual disabilities  |                            |                                |         |
| 6 (14.3%)                         | 25 (40.3%)                 | < 0.01                         |         |

Vision measures:

| Vision measures                      | Normal vision | Visual impairment | p-value |
|-------------------------------------|---------------|-------------------|---------|
| Distance acuity of the better eye (LogMAR) | 0.30 (0.26)   | 0.87 (0.55)       | < 0.001 |
| Near acuity (LogMAR)                | 0.21 (0.35)   | 0.65 (0.89)       | < 0.001 |
| Contrast sensitivity (LogCS)        | 1.64 (0.30)   | 1.60 (0.86)       | 0.08    |

Functional measures:

| Functional measures                  | Normal vision | Visual impairment | p-value |
|--------------------------------------|---------------|-------------------|---------|
| Mailbox (MB) – average completion time (s) | 1.68 (1.37)   | 1.78 (1.42)       | 0.71    |
| Heidi cards (HC) – average completion time (s) | 11.00 (13.25) | 15.34 (19.90)     | 0.14    |
| Heidi faces (HF) – average completion time (s) | 15.00 (25.33) | 18.00 (36.30)     | 0.52    |
| Time-up-go (TUG) – average completion time (s) | 10.60 (4.52)  | 13.61 (9.05)      | 0.03    |
| Static balance (medial-lateral sway, ML) (cm)* | 1.62 (0.93)   | 1.87 (1.05)       | 0.37    |
| (i) Feet-together with eye open (FO) | 1.92 (0.68)   | 2.45 (0.91)       | 0.02    |
| (ii) Tandem stance with eye open (TO) | 1.47 (1.23)   | 1.81 (1.50)       | 0.24    |
| (iii) Feet-together with eye close (FC) | 2.69 (0.97)   | 2.23 (1.39)       | 0.39    |

* Only 20 (47.6%) and 32 (51.6%) students from the NV and VI groups, respectively, could complete the different conditions in the static balance.
The results for different balance variables are shown in Figure 2. In general, SEN students’ static balance function varied substantially when measured in different conditions. Results from the two-way repeated measures ANOVA showed that the within-subject main effects for eye condition (i.e. eye open vs. eye close) and feet condition (i.e. feet together vs. tandem stance) were insignificant (F_{1,50} < 1.15, all p > 0.05) in all the outcomes, as was between-subject effect for vision group (i.e. NV vs. VI) (F_{1,50} < 0.92, all p > 0.05). However, the interaction between the eye condition and vision group was significant in V (F_{1,50} = 4.24, p = 0.05) and L (F_{1,50} = 4.66, p = 0.04), revealing that the absence of visual input (i.e. eye close condition) had stronger impact on balance function in students with NV than VI. Further interaction among all three factors (eye condition, feet condition, and vision group) was significant in the ML (F_{1,50} = 7.44, p = 0.01), but not in other outcomes (p > 0.05). Detailed statistical results are listed in Table 2.

In post-hoc pairwise comparisons, NV students swayed significantly less in ML than VI students under TO condition (p = 0.04), but ML sway became significantly greater under closed eye condition (p = 0.02). Similar findings were observed for V and L with NV students having significantly less sway under closed eye than open eye condition (p = 0.03). In contrast, VI students swayed significantly more than NV student in V and L under eye closed and tandem stance condition (p = 0.03). The findings demonstrated that when visual input was provided (i.e. open eye condition), students with normal vision had better static balance performance. However, when visual input was deprived (i.e. close eye condition), students with vision impairment swayed significantly less.
Figure 2. Static balance sway parameters in different eye and feet conditions of normal (NV) and vision impairment (VI) groups. (A) Medial-lateral sway (ML); (B) Antero-posterior sway (AP); (C) Sway variability (V); (D) Sway path length (L). FO: Feet together standing with eye open; TO: Tandem stance with eye open; FC: Feet together standing with eye close; TC: Tandem stance with eye close. The graph is plotted with transformed data, and the error bars represent the standard error of mean.
Table 2. Results of two-way mixed repeated measures ANOVA for static balance measures.

|                        | Medial-lateral sway (ML) | Antero-posterior sway (AP) |
|------------------------|--------------------------|----------------------------|
|                        |                          |                            |
| Group                  | 0.92                     | 0.18                       |
| Eye condition          | < 0.001                  | 0.08                       |
| Feet condition         | 0.001                    | 1.15                       |
| Eye * Group            | 2.92                     | 0.34                       |
| Feet * Group           | 0.33                     | 3.37                       |
| **Eye * Feet * Group** | **7.44**                 | **1.85**                   |

|                        |                          |                            |
| Group                  | 0.61                     | 0.50                       |
| Eye condition          | 0.21                     | 0.09                       |
| Feet condition         | 0.06                     | 0.02                       |
| **Eye * Group**        | **4.24**                 | **4.66**                   |
| Feet * Group           | 1.25                     | 1.46                       |
| **Eye * Feet * Group** | **2.22**                 | **2.14**                   |

* indicates p < 0.05, ** indicates p < 0.01

**Discussion**

This study is the first to our knowledge to examine the effect of vision on two essential daily tasks – visual processing and balance functions in children with SEN attending special care schools. In line with previous findings, prevalence of reduced visual acuity was high in this study. Our findings showed that vision did not play a major role in the poor performance in functional tests, such as orientation recognition and facial recognition – two important visual processing tasks. In contrast, vision was significantly associated with the balance function, both dynamic and static. SEN students with visual impairment had poorer performance in TUG test and sway parameters under open eye condition. However, when the visual input was deprived (i.e. eye close condition), students with normal vision performed significantly worse than those with visual impairment.
Previous studies have reported an increased risk, as high as 75%, of visual impairment in disabled children, whereas the current study found 59.6% of students attending the special schools had reduced vision, although this figure did not include those SEN students with solely visual impairment (n = 23). In the US, cortical visual impairment was the leading cause of visual impairment and blindness in children and constituted 19% of the visually challenged children. Our study, echoes the previous studies in finding that the causes of reduced vision for 24.8% of the SEN students were likely to be neurological, while the remainder were due to different types of ocular anomalies (e.g. optic atrophy, glaucoma). Although the types of disabilities were self-reported by guardians or teachers rather than full medical records (because of compliance with patients’ privacy), it was speculated that cerebral visual impairment was likely to be the major cause of vision loss in students attending the special schools.

Vision did not appear to be a major obstacle for visual processing functions. As in a previous study, visuo-spatial and visuo-perceptual abilities were found to be impaired in 90% and 60% of subjects with cerebral palsy, respectively, in terms of orientation judgement and facial recognition, which was independent of their visual acuity. Facial details processing deficits are also common in autistic spectrum disorder, even if autistic individuals have normal vision, leading to problems such as unsustainable eye contact and switching focus for social function. Inhibition of visual input caused by visual impairment might have limited impact of such social information. In the current study, orientation judgement and facial expression recognition were similar in both groups of students – normal vision and visual impairment. Similarly, age did not show a significant association with the performance in visual processing functions (Spearman’s test, p > 0.05). In line with previous studies, our results indicated that non-visual disabilities, e.g. intellectual disability, might attribute for the impaired visual processing functions instead of vision itself. Further studies on functional assessments, such as joint attention and imitation, are warranted.

The balance functions of SEN students are reduced, regardless of the type of disability. In children with normal development, the dynamic balance function measured by TUG ranged from approximately 4 to 7 s. The time needed to complete the TUG task increased from a median of 7.5 s in gross motor function classification system level I, to 17.8 s in level II, and finally 50.7 s in level III for children with cerebral palsy, while was approximately 9 s in adolescents with
Down syndrome. Our sample recorded a median of 10.60 s and 13.61 s in SEN students with normal vision and vision impairment, respectively. The correlation analysis showed a significant but weak association between habitual visual acuity and TUG (Spearman’s ρ = 0.23, p = 0.04). This indicated that visual and non-visual disabilities compromise SEN students’ dynamic balance function in different ways and might have a composite effect, as dynamic balance function was further reduced in students with both visual and non-visual disabilities. Several studies have compared static balance function in sighted and visually impaired children. In summary, they concluded that visually impaired individuals had greater postural sway than sighted individuals under open eye condition, especially in single-leg-standing positions: adults, adolescent, and children. However, no significant difference were observed between the sighted and visually impaired individuals under closed eye condition. In the current study, a similar outcome was found in SEN students. Those students with normal vision had better static balance performance in open eye condition than those with visual impairment under tandem stance, while no significant difference was observed in feet together standing. When visual input was deprived (i.e. eye closed condition), their static balance function became significantly poorer. However, students with both visual and non-visual disabilities (i.e. VI group) swayed similarly under eye open and eye closed conditions. It is speculated that students with visual impairment may rely more on their somatosensory and/or vestibular inputs rather than vision to maintain their postural control, while NV students rely more on the visual input. Coincidently, it was observed that similar balance performance was found in older adults with VI. They swayed significantly more than NV subjects in static standing under eye open, but displayed no difference with sighted aged-match subjects when eyes were closed. The reliance on somatosensory input was shown when subjects with VI stood under a sway-reference support surface with eye open swayed significantly more than the sighted subjects. Further studies examining the contribution of multi-sensory inputs to postural control, and functional activities, such as obstacle avoidance and crossing, are needed. Such knowledge could facilitate the design of balance training protocols for students with SEN.

Taiwan initiated a national-wide registry policy for children with disabilities in 1980’s to better understand and provide support for the SEN. The combined prevalence of SEN increased from 1.0% to 1.5% over three decades, affecting more boys, especially in rural areas. Institutionalised care, e.g. special schools, has been the mainstream for the special care service,
providing educational, occupational, and vocational training for registrants. Although resources
had been pooled for rehabilitation services, the prevalence of the beneficiaries were still low,44 in
which the service recipients only accounted for 24.5% of an 957-subject SEN sample within a 7-
month period. As well as the SEN themselves, the primary family carer may also experience
challenges, which the carers’ health status and quality of life can be significantly lower.45 In the
current study, despite the students attending special care schools, awareness of visual impairment
in the guardians or teachers was still low, in that only 40.3% reported their children or students
to have visual impairment. In addition, near one third of the SEN students (n = 32) were found to
have uncorrected / under-corrected refractive error, whose visual acuity was significantly
improved by an average of LogMAR 0.33 by merely updating their optical aids. This
phenomenon indicates the necessity of regular eye examinations in this special population, as
suggested in previous studies.8, 9, 46

There were several limitations in the current study. Firstly, the self-reporting disability status was
less reliable than reviewing a full medical history. However, due to the compliance with patient
privacy, this information could not be retrieved from the guardians or teachers. Secondly, the
severity of non-visual disabilities was not assessed in the current study, which is speculated to
affect the capability of SEN student to perform different tasks. Most of our tests required
students to have a certain degree of cognitive ability to participate. It is not surprising that almost
half of the participating students could not complete the various conditions in balance
measurement, in particular the tandem stance in eye closed condition. Finally, this study lacked a
longitudinal follow-up to observe the effect of improved vision after updated optical corrections
on visual processing functions and balance functions in SEN students.

To conclude, visual impairment in SEN students is common. However, despite the high
prevalence of visual impairment in this population, our findings suggested that some SEN
students’ visual function could be improved by prescribing appropriate and updated refractive
correction. Although reduced vision is not a major limiting factor explaining the deficits of
visual processing function in these SEN students, vision remains an important integral for
children’s all-round development. Adequate visual input was also found to be critical for SEN
students to maintain their dynamic and static balance functions. Hence, regular checking and
preserving the vision for SEN students is of high importance.
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