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Comparison of Unipedal Stance Test for the Assessment of Balance Among Blind and Blind Folded Sighted Children: A Cross-Sectional Study

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***Abstract*---**This study aims to compare the unipedal stance test for assessment of balance among blind and blind folded sighted children. Balance of the body requires coordination of input from various sensory systems like somatosensory, visual and vestibular system. Any disparity in any of these systems may have negative impact on maintaining the posture balance. A cross sectional study was conducted on 181 blind folded sighted and 150 blind children aged 10-17 years. The unipedal stance test was used to assess postural balance. The children were instructed to stand comfortably on a bare foot of their choice with other foot raised. A stop watch was used to record time duration to stand on one foot. The best of the three trials was taken as a final result of that participant. Statistical analysis was done with the help of unpaired t test. Blind folded sighted children showed the significantly better postural balance (P=0.0001). On age wise comparison among blindfolded sighted children and blind children, blind folded sighted children showed more stable postural balance right from younger age group to older age group than the blind children of the same age group (P=0.0001).

***Keywords*---**comfortable, foot, posture, stable, vision.

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Introduction

Balance is an ability to hold the line of gravity of a body within the foundation of support with little or no postural swing. Preserving balance needs coordination of input from many sensory systems like somatosensory, visual systems and vestibular (Horak, 1987; Hanke et al., 1992). Somatosensory system is the segment of the sensory system link with the awareness perception of touch, temperature, pressure, movement, pain, vibration and position which comes out from the muscles, skin, joints and fascia. Visual system incorporates the eye and the portion of the CNS that enables ones with the ability to exercise ocular detail as sight, as well as allowing the production of many non-image picture response functions. Vestibular system is a part of sensory system, accountable for supplying our brain the information regarding movement, head position and spatial adaptation (Gribble, P.A., & Hertel, J., 2004).

Cautious movement initially depends on the incorporation of the optical, proprioceptive, and vestibular information. Sensory proprioceptive information are conveyed to various extents of the central nervous system but many endure unconscious and only a little is able to reach the aware level (Riva et al., 2013). The position of joint perception and joint movement perception are the assertion of the awareness part. Whereas the control in posture is generally mediated the unconscious part. In such a case of the movements against gravity, proprioceptive command is the assertion of the effectiveness of the preserving reflexes in maintaining erected stability (Riemann & Lephart, 2002).

By movements against gravitation, it indicates activities that required by a person to impede gravity and postural instability with at least a phase of single-limb leg (Sherrington, 1906). Proprioceptive informations are the essential sensory system in the conservation of fixed postural stability at all ages (Riva et al., 2013). Many observations have suggested that impaired vision decreases postural firmness and enhances the risk of falling in aged person (Freeman et al., 2008). Accordingly, enhancing vision is a successful strategy for inhibiting falls (Lord et al., 2010).8 Other observations have founded that visual field dependence as postural balance is a risk factor (Tobis et al., 1985). This visual dependence can evolve in reaction to damaged proprioceptive and vestibular systems as a outcome of age and persistent health problems (Balogun et al., 1994).

Some previous observers have analyzed the balance scores of blind and sighted participants and only a restricted number of studies compared the balance scores between blind folded sighted and blind subjects. These observations mainly indicate that participants with healthy vision have better postural stability than those with no vision participants (Baş et al., 2020). The main aim of the present study was to compare unipedal stance test for assessing balance among blind and blindfold normal sighted children in different age group of 10-17 years.

Materials and Methods

Study design

The study was conducted on 181 sighted and150 blind subjects of either sex of age group between 10-17 years in the Department of Physiology, RKDFMCH&RC, Bhopal. The written informed consent was received from all the participants (331) and ethical clearance (Ref outward No.540A) was obtained from Institutional Ethical Committee prior to conduct the study.

Period of the study

The study was conducted from 1st October 2017 to 1st April 2019 (i.e., for a period of 18 months) and the tests were done between the timing of 10:00am – 4:00pm.

Sampling

The study was carried on 331 children out of them 150 were blind and 181 were normal sighted considered as a control group. Cases were selected from different Blind schools of Bhopal and control was randomly selected from Government school Bhopal.

Inclusion criteria:

- Age between 10 – 17 years of both sexes.

Exclusion criteria

Any types of neurological illness that affect our sensory and motor function, brain damage, traumatic brain injury, autoimmune disorder, substance abuse, attention deficit disorder, learning disability.

Statistical analysis

Statistical analysis was done with the help of unpaired t - test of SPSS ver.20

Unipedal stance test

Instruction was given to participant to stand comfortably on bare foot of the limb of their choice, with the other limb raised so that the raised foot was near but not touching the ankle of their stance limb. Before raising the limb, participant was asked to cross his arms over the chest. A stopwatch was used by observer to assess the amount of time taken by participant to stand on one limb. Time commenced when participant lifted the foot off the floor. Time elapsed when the individual either used the raised foot or, utilized his uncrossed arms or, moved the foot bearing weight to maintain his balance. Participants were given practice session in which they repeat the same procedure for three times and recorded on data collection sheet every time. The best of the three trials was taken as a final unipedal stance test score of that participant. Participant was allowed to relax for at least 5 minutes in every trial to avoid tiredness (Spriger et al., 2007).

Results and Discussions

Results

The mean ± S.D value of unipedal stance in normal blind folded sighted and blind was 32.66± 10.33 sec and 27.45±2.60 sec respectively. This was found to be statistically significant (P =0.0001).

Table 1
Comparison of unipedal stance test in normal blind folded sighted and blind children

Variable	Groups (Mean + S D)		Unpaired t – test
	Blind folded Sighted children	Blind children	P – Value
Unipedal stance test	32.66±10.33 Sec	27.45±2.60 Sec	0.0001

On comparison of unipedal stance test in different age groups of normal blind folded sighted and blind children, blind folded sighted children in different age group have longer unipedal stance than the blind children of the same age group as shown in table 2. The older children either blind folded sighted or blind have shown statically significant longer unipedal stance than the younger children of the same groups (P=0.0001).

Table 2
Comparison of unipedal stance test in different age groups of normal blind folded sighted and blind children

Variable	Age groups	Blind folded sighted children		Blind children		Unpaired t – test
		No. of children (n)	Mean±SD (Sec)	No. of children (n)	Mean±SD (Sec)	P – Value
Unipedal Stance Test(sec)	10yrs	6	26.33±1.51	3	17.67±2.08	0.0002
	11yrs	25	25.76±2.49	21	19.76±3.05	0.0001
	12yrs	25	26.24±1.81	21	20.86±2.78	0.0001
	13yrs	25	26.96±1.77	21	21.81±2.62	0.0001
	14yrs	25	27.44±2.18	21	22.71±2.63	0.0001
	15yrs	25	28.08±2.83	21	23.24±3.92	0.0001
	16yrs	25	28.92±2.29	21	24.43±4.33	0.0001
	17yrs	25	29.20±2.81	21	24.00±3.29	0.0001
Unpaired t – test		0.0001		0.0001		

Discussion

The study analysed the postural balance with the use of unipedal stance test in blind as compared with normal sighted children (aged 10-17 years). The data so far obtained in this study revealed that the blind children had statistically lower postural balance than the blind folded sighted children. Several previous observations have highlighted that blindness reduces postural balance (Baş et al., 2020). In our study, we too had observed that the blind folded sighted in different age groups showed increased postural balance than the blind children of the same age groups in the unipedal stance and hence their observations were very much similar to the findings of others (Barbara et al., 2007).

The truth about the difficulty in maintaining the postural balance without vision suggests that the processes of balance control are mostly dependent on vision (Tomomitsu et al., 2013). Kayihan et al., examined the balance and tactile perception. They studied on 29 visually challenged children and 41 with low vision children aged 11-20 years along with 40 sighted children as a control group. They had observed that the children with healthy vision had longer duration in unipedal stance test (Kayihan et al., 1989).15 In addition, observers had found the inability in the process of vision-balance that negatively resulted the functioning of postural stability (Pereira, 1990).16 The visionless children in our study, the time of postural balance was estimated to be shorter in comparison to the normal sighted children, this observation tally with studies of others (Baş et al., 2020).11 The balance control on a unipedal stance was generally dependent on the visual information. During the trial position of the test, the proprioceptive load reduced and in that instances the visual and vestibular loads became more pronounced. Considering that minimum sighted children, who experienced lesser amount of visual loads, only vestibular load was used to maintain the postural balance and hence, the overall presentation of the children in terms of postural balance was negatively affected (Loughran et al., 2005).

Kayihan et al., pointed out those blind participants required more exposure in their day to day activities due to the delay in the growth of motor skills (Kayihan et al., 1989). 15 In this study, we observed that the older children either blind folded sighted or blind have shown statically significant longer unipedal stance than the younger children of the same groups. This observations coincides with the observations of Bauchard et al., who compared 30 blind children with 30 normal sighted children aged 8–13 years old and estimated that blind children had exhibited growth of weak motor skill (Bouchard & Tetreault, 2000).

Murphy et al., observed the factors of pace, deftness, balance, and motor skills in six sightless children aged 5–6 years for more than two years. Finally, they recorded the issues in the sightless children in terms of these skills (Murphy et al., 1989).19 Piereira et al., observed that when normal sighted person and blind person of same age group were compared with respect to their overall performance in balance control, the latter group performed relatively weakly (Piereira et al., 1990). Weak in balance is a common finding among blind people that increase the risk of falling (Salonen & Kivela, (2012). Consequently the sighted individuals have more balance stability (Lord & Webster, 1990).

Conclusion

It has been observed that the blind folded sighted children aged between 10-17 years have longer unipedal stance than the blind children of the same age group. Thus, the present study concluded that the postural stability was statistically poor among blind children in comparison to the normal sighted children. This is because the processes of balance control are mostly dependent on vision. The older children either blind folded sighted or blind have shown statically significant longer unipedal stance because of the previous exposure and developed muscle strength than the younger children of the same groups.

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