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Balance in Adolescents with and without Visual Impairments

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Abstract

Research has found balance to be significantly delayed in children and adolescents with visual impairments in comparison to their sighted peers, but the relationship between balance self-efficacy and actual balance is unknown. This study examined dynamic and static balance and balance self-efficacy in adolescents who are blind (B) and have low vision (LV); the role of visual experience upon balance, sighted (S) and sighted blindfolded (SB); and the relationship between perceived and actual balance. The results revealed that the degree of impairment (LV compared to B) and experience with vision (SB compared to LV and B) were significant factors in many of the balance assessments, but not the balance self-efficacy ratings. Main effects for self-efficacy ratings and significant correlations for self-efficacy and balance measurements were only found for a few of the more difficult tasks. In conclusion, it is important to examine both motor performance and self-efficacy in adolescents with visual impairments on a variety of familiar tasks and contexts to gain a thorough understanding of the individual's balance. This information is essential when developing appropriate and effective balance interventions for adolescents with visual impairments.

Keywords: balance, visual impairments, adolescents, posture, physical activity

Introduction

Children rely more heavily upon vision for balance than any other sensory information (Casselbrant, Mandel, Sparto, Redfern, & Furman, 2007; Foster, Sveistrup, & Woollacott, 1996). This information is important as balance is a critical component in the performance of all motor activities, both functional and sport related (Ferdjallah, Harris, & Wertsch, 2002). For example, young children use vision to make quick postural compensations to maintain their body position when acquiring new fundamental locomotor skills, such as walking with and without support (Delorme, Frigon, & Lagace, 1989). Around the age of 7 to 8 years, children exhibit significantly improved postural control through a reduction in the magnitude and velocity of their center of pressure (COP) motion (Kirshenbaum, Riach, & Starkes, 2001). It has been suggested that these postural improvements are a result of improved use of sensory feedback from proprioceptive, visual, and vestibular inputs.

Children of the same age with reduced or no vision have been found to have significant delays in postural control in comparison with age-matched controls (Bouchard & Tetrault, 2000; Navarro,

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Fukujima, Fontes, Matas, & Prado, 2004). Significant differences begin to be apparent in toddlers (Brambring, 2006). These delays are particularly striking in dynamic balance tasks (i.e., walking along a line, hopping, and walking on tiptoes), in comparison to static balance tasks (i.e., quiet standing), with developmental divergences as large as 21 months or more during dynamic balance tasks, as opposed to 2.7 months during static balance tasks in toddlers with visual impairments. This divergence between static and dynamic balance is likely due to an increased contribution of other sensory systems (i.e., the vestibular and proprioceptive systems) during static postural control, whereas dynamic postural control requires a higher reliance upon visual control (Brambring, 2006). It is not known whether this divergence in balance in children with and without visual impairments continues beyond childhood.

Although there is clear evidence that individuals with visual impairments experience reduced balance, there is no clear relationship in regard to the degree of visual impairment (Houwen, Visscher, Hartmen, & Lemmick, 2007; Houwen, Visscher, Lemmick, & Hartman, 2008). There is not enough evidence to establish a relationship between the degree of visual impairment with static balance (Houwen et al., 2007; Houwen et al., 2008), and only weak evidence has been found for dynamic balance and the degree of visual impairment (Ribadi, Rider, & Toole, 1987; Wyver & Livesey, 2003). Further research needs to be conducted on the relationship between individuals with low vision and blindness upon both static and dynamic balance to better understand the extent and type of postural control and balance delays between these two groups. To further examine this issue, an assessment of sighted blindfolded adolescents, in addition to adolescents with and without visual impairments, would allow an investigation of the role of postural control experience without visual feedback, because the sighted adolescents will have had minimal experiences with adapting their postural control to a sudden loss of vision. Adolescents with sight have minimal balance experience without visual feedback. By wearing blindfolds, sighted individuals are forced to reweight their sensory information from a heavy emphasis upon vision to proprioception and vestibular information (Ribadi et al., 1987).

In addition to these assessments, it is important to assess the self-esteem of adolescents with visual impairments. Motor performance has been linked to self-esteem in that individuals with lower self-esteem are less likely to fully develop fundamental motor skills (Losse et al., 1991; Shaw, Levin, & Belfer, 1982), and self-esteem in adolescents with visual impairments has been found to be lower than that of their sighted peers (Shapiro, Moffett, Lieberman, & Dummer, 2008). Children and adolescents who do not acquire fundamental motor skills tend to experience social problems and perform more poorly academically (Brown & Brown, 1996; Lieberman, Volding, & Winnick, 2004). In recognizing that children with visual impairments often have lower self-esteem, efforts to improve self-esteem or related factors may have beneficial effects upon motor performance, beyond directly targeting motor performance alone. Interventions that only focus upon motor performance may also improve self-esteem; however, targeting both may have a greater impact than performance or self-esteem, or related factors, individually.

A factor that is related to self-esteem is self-efficacy, that is, an individual's perceived ability to perform a task. There has been a strong relationship found between self-efficacy and motor performance (Holbrook & Koenig, 2007; Willoughby & Polatajko, 1995). Self-efficacy and sense of competence is reduced in individuals who perform more poorly than their peers (Harter, 1989). Individuals with impaired postural control and balance often have lower balance self-efficacy, which may be due to intentionally reducing participation in physical activity on the part of individuals with lower self-efficacy (Ray, Horvat, Williams, & Blasch, 2007; Stuart, Lieberman, & Hand, 2006; Vellas, Wayne, Romero, Baumgartner, & Garry, 1997). A decline in physical activity, as well, has been linked to reductions in balance, which can lead to difficulty in the maintenance of balance during even simple activities. Furthermore, it has been suggested that self-reports of an individual's own abilities can provide reliable data on their functional abilities as well as increase their involvement in their treatments and improve the effectiveness of the treatment (Berry & West, 1993). The present study sought to expand the knowledge of static and dynamic balance in adolescents with low vision and blindness and determine how balance abilities affect adolescent's self-efficacy related to balance.

In summary, there is little research examining static and dynamic balance in adolescents with visual impairments (Häkkinen, Holopainen, Kautianinen, Sillanpää, & Häkkinen, 2006; Leonard, 1969; Ribadi et al., 1987) and no research correlating balance measures with self-efficacy related to balance in adolescents. The purpose of this study was to determine whether perceived confidence (self-efficacy) related to balance is related to actual balance in adolescents with visual impairments (blind and low vision). More specifically, the purposes of this study were to (a) examine and compare static and dynamic balance in adolescents across four groups, blind (B), low vision (LV), sighted (S), and sighted blindfolded (SB); (b) compare the perceived self-efficacy of balance across each group; and (c) examine the correlations between static and dynamic balance and self-efficacy of balance within each group.

Methods

Participants

A group of 44 adolescents (boys, *n* = 24; girls, *n* = 20) with and without visual impairments between the ages of 12 and 17 years (*M* = 14.05 years, *SD* = 1.63) participated in this study. The adolescents with visual impairments were categorized (total or legal blindness) according to the United States Association for Blind Athletes (USABA) sport classifications: Blind (B1s; 3 girls and 8 boys; *M* = 13.27 years, *SD* = 1.42 years) and low vision (B3s; 6 girls and 5 boys; *M* = 13.73 years, *SD* = 1.56 years). Nineteen of the 22 adolescents were congenitally blind. The onsets of the visual impairments for the other three participants were ages 4 months (LV), 16 months (B), and 5 years (LV). The sighted adolescents included 11 girls and 11 boys (*M* = 14.55 years, *SD* = 1.6 years) randomly broken into two groups, sighted (S) and sighted blindfolded (SB). These participants and their parents signed informed consent forms reviewed by the college's institutional review board committee.

The participants with visual impairments in this study were recruited from a 1-week sports camp for children and adolescents with visual impairments, blindness, or deaf-blindness. Although they are not all on sports teams and do not typically participate in weekly sports, this is a limitation. The participants may perceive themselves to be "athletes" and therefore display better balance than a child who does not attend a sports camp and consider themselves athletes. The reason the researchers went to the sports camp for the study was to increase the sample size because children with visual impairments are considered a low-incidence population.

Equipment

An AMTI AccuGait Portable force platform (AMTI, Newton, MA) was used to measure the amount of postural motion in both the mediolateral (side to side) and anteroposterior (front to back) directions during the static conditions. Force plates are a common method of measuring postural stability (Cheng, Lee, & Su, 2003; Haibach, Slobounov, & Newell, 2008; Haibach, Slobounov, Slobounova, & Newell, 2007a, 2007b) and are a valid and reliable measure of balance (Cheng et al., 2003; Haibach et al., 2008). The force platform records the postural dynamics with three force components: the mediolateral force (Fx), anteroposterior force (Fy), and the vertical force (Fz). The force platform data were sampled at a rate of 100 Hz and the excitation voltage was set to 5 V. The raw data were filtered at a cutoff frequency of 20 Hz to reduce noise. The AMTI force platform was connected to a personal computer via a 16 bit analog-digital (A/D) conversion board.

A Lafayette Stability platform with digital control, model 16030 (refer to Figure 1), was used for two additional dynamic balance conditions. The stability platform has been found to be a reliable and valid measure of dynamic balance (J.F. Murray, 1982; Nashner, 1982). The stability platform has an angle measurement resolution of 1 degree and a platform tilt range of + 30 degrees. The output voltage was set at 5 volts and the analog output rate was 25 samples per second. The stability platform measured the movement time and provided an angle measurement of the platform tilt from a parallel position to the ground.

Procedures

The participants were tested during a 1-week sports camp for children with visual impairments. Before testing, a 17-question balance self-efficacy survey was read to each participant. The survey was adapted from two validated questionnaires, the Powell and Myers (1995) Balance Confidence Scale (ABC) and the Falls Efficacy Scale (FES). In this survey, participants rated their self-efficacy of

Figure 1. *Lafayette Stability Platform (http://www.si-instruments.com/products/lafayette/stability-platform.php).*

balance using a Likert scale from 0 (*no confidence*) to 5 (*complete confidence*) on activities such as walking around the house, getting dressed, and walking on icy sidewalks. The self-efficacy questionnaire used in this study has been validated in older adults and for face and content validity by three professionals in the field for adolescents with visual impairments. The experts reviewing the items for this questionnaire were an adapted physical education specialist with expertise in visual impairment and two experts in motor control specializing in balance and postural control. Further validation is currently being conducted.

Participants completed four tasks on the force platform. The five COP measures were used for Conditions 1 to 4. For Condition 1, participants rotated their body in a circular direction leaning as far as possible by bending at the hip. If a step was initiated, the trial was aborted. This condition was performed to obtain the maximum stability boundary of each participant. The other three conditions measured static balance at various levels of difficulty. For Condition 2, low difficulty, participants were instructed to stand as still as possible on the force platform. Participants stood with a tandem stance, one foot in front of the other for Condition 3, moderate difficulty. For Condition 4, high difficulty, participants stood with one foot. The duration of each trial was 20 sec.

Participants completed two tasks on the Lafayette stability platform to assess dynamic stability. Verbal instruction and tactile modeling were used to help the participants with visual impairments understand the procedures for the stability platform. The tactile modeling allowed the participants to feel others completing the movement (O'Connell, Lieberman, & Petersen, 2006). All participants were instructed to hold the bar when stepping onto the stability platform and continue holding the bar until they felt comfortable with the apparatus and understood all movements. Participants with visual impairments were also physically assisted onto the stability platform. Prior to testing, all participants were given an opportunity to become comfortable with the task by moving the platform laterally with and without holding onto the bar. It was important for the participants to fully understand the protocol for reliable testing of their total balance capabilities.

For Condition 5, participants began with the stability platform tilted to one side such that the platform was touching the floor to their right side. At the onset of the beep, they were to move the platform to an angle of 0 degrees (parallel to the floor) as quickly as they could and hold it there for the duration of 30 sec. For Condition 6, participants began with the stability platform at 0 degrees. Following the beep, participants were instructed to tilt the platform to each side by leaning in each direction, continuously moving back and forth as quickly as possible for trial durations of 30 sec. Conditions 5 and 6 were completed three times each.

Data Analysis

Static and dynamic balance have often been assessed by reference to properties of the *amount* of motion of the COP (amplitude, velocity, acceleration properties), such that the degree of motion away from the equilibrium point is reflective of the degree of postural instability (Goldie, Bach, & Evans, 1989; M.P. Murray, Seirewg, & Sepic, 1975). COP represents the point of application of the ground reaction force (Enoka, 1988). Comparisons of COP measures were examined across each of the groups. The total deviation of COP and the COP area recorded by the force platform provide measures of the amount of postural motion (Benvenuti et al., 1999; Winter, 1987). Measures of COP included the COP area (total area of the COP), COP length (the total displacement of the COP in both x and y directions), COPy (COP in the anteroposterior direction), COPx (COP in the mediolateral direction), and COP velocity (the second derivative of COP position).

The amount of time required to bring the platform to zero degrees was analyzed during Condition 5 from the stability platform and comparisons were made across groups. For the maximum motion condition (Condition 6), the number of lateral movements, individually and jointly, and the maximum and minimum angular excursions were analyzed.

Descriptive statistics (including means and standard deviations) and analysis of variance (ANOVA) of COP and the stability platform measures were computed. The dependent variables derived from these time series were placed independently in a two-way, Group 4 × Condition 4 ANOVA. Spearman's correlation was used to examine the correlations between the balance measures and the balance self-efficacy scores. The statistical tests were set at a level of .05.

Results

Static and Dynamic Balance

The results of Condition 1, stability boundaries, the area of the stability region as indexed by the motion of the COP, revealed that LV and B had significantly smaller stability boundaries (refer to Figure 2b) than their age-matched controls, S and SB (*p*s $< .05$). For the stability boundary condition, significant main effects were found across groups for COPx, $F(3, 84) = 4.37$, $p < .05$; COP area, $F(3, 84) = 10.15$, $p < .05$; and COP velocity, $F(3, 8) = 5.00$, $p < .05$, but not for COPy or COP length (*p*s $< .05$). All of the COP measures were highly correlated (*p*s $= .00$) with one another, so only a few of the COP measures are discussed in detail. Tukey's post hoc analyses revealed that both control groups had significantly greater COP area (*p*s $> .05$) in their stability boundary than LV and B. The majority of this additional COP area was in the mediolateral direction revealing that LV and B were much less able to lean in the sideways directions in comparison to the sighted participants.

During Conditions 2 to 4, where decreased motion reveals better balance, LV and B had significantly more postural motion (refer to Figure 2a) indicating that they are much less stable than their sighted peers. An interaction was found for COPy and COP length, $F(9, 336) = 2.15$, $p < .05$, and $F(9, 336) = 2.15$, $p < .05$, respectively. A main effect was also found for group and condition (*p*s < 0.05) for COPy and COP length. Tukey's post hoc analyses revealed group differences. S exhibited the least amount of COP motion, and B exhibited the greatest amount of postural motion for both COPy and COP length (*p*s < 0.05), significantly more than LV, SB, and S. COPy ranged from a mean of 5.58 cm (B) to a mean of 1.55 cm (S) for the standing still with a comfortable stance condition. The differences were even greater for the tandem stance. Similar effects were found for the COP velocity, group effect, $F(3, 335) = 2.83$, $p < .05$, and group by condition interaction, $F(9, 335) = 1.99$, $p < .05$. There were no significant effects for COPx.

Dynamic balance was further assessed using a stability platform. There was a significant main effect for time to stabilize (refer to Figure 3a), with decreased time to stabilize indicating better postural control, across groups during the stability platform Condition 5, $F(3, 126) = 4.13$, $p < .05$. B and LV required significantly more time to stabilize the platform than either of the control groups. SB required significantly more time than S (*p*s $< .05$) to stabilize the platform with mean times of 3.7 sec and 2.3 sec, respectively. There was no significant difference between the B and LV requiring 5.65 sec and 5.19 sec, respectively. Participants did not improve across trials (*p*s $> .05$).

During Condition 6, maximum motion, S and SB displayed significantly more motion in both the left and right directions (refer to Figure 3b) than LV and B, $F(3, 126) = 5.16$, $p < .05$, $F(3, 126) = 9.29$, $p < .05$, respectively. Interestingly, there was no significant difference (*p*s $> .05$) for the number of lateral excursions from left to right across groups. Rather than move at a higher frequency, S and SB performed at a similar speed but produced larger amplitudes in both the left and right directions (refer to Figure 4).

Self-Efficacy of Balance

Prior to testing, balance self-efficacy assessments were conducted to compare each group's perceived balance. It was expected that adolescents with visual impairments (both blind and low vision) would score lower on the balance self-efficacy questionnaire than the sighted adolescents. Although there was a trend for the sighted participants to rate themselves higher, there was no significant difference when all of the questions were averaged, $F(3, 67) = 1.11$, $p = .351$. B did, however, have much greater variability than the sighted participants. A couple of the participants in the B group gave two ratings for more difficult

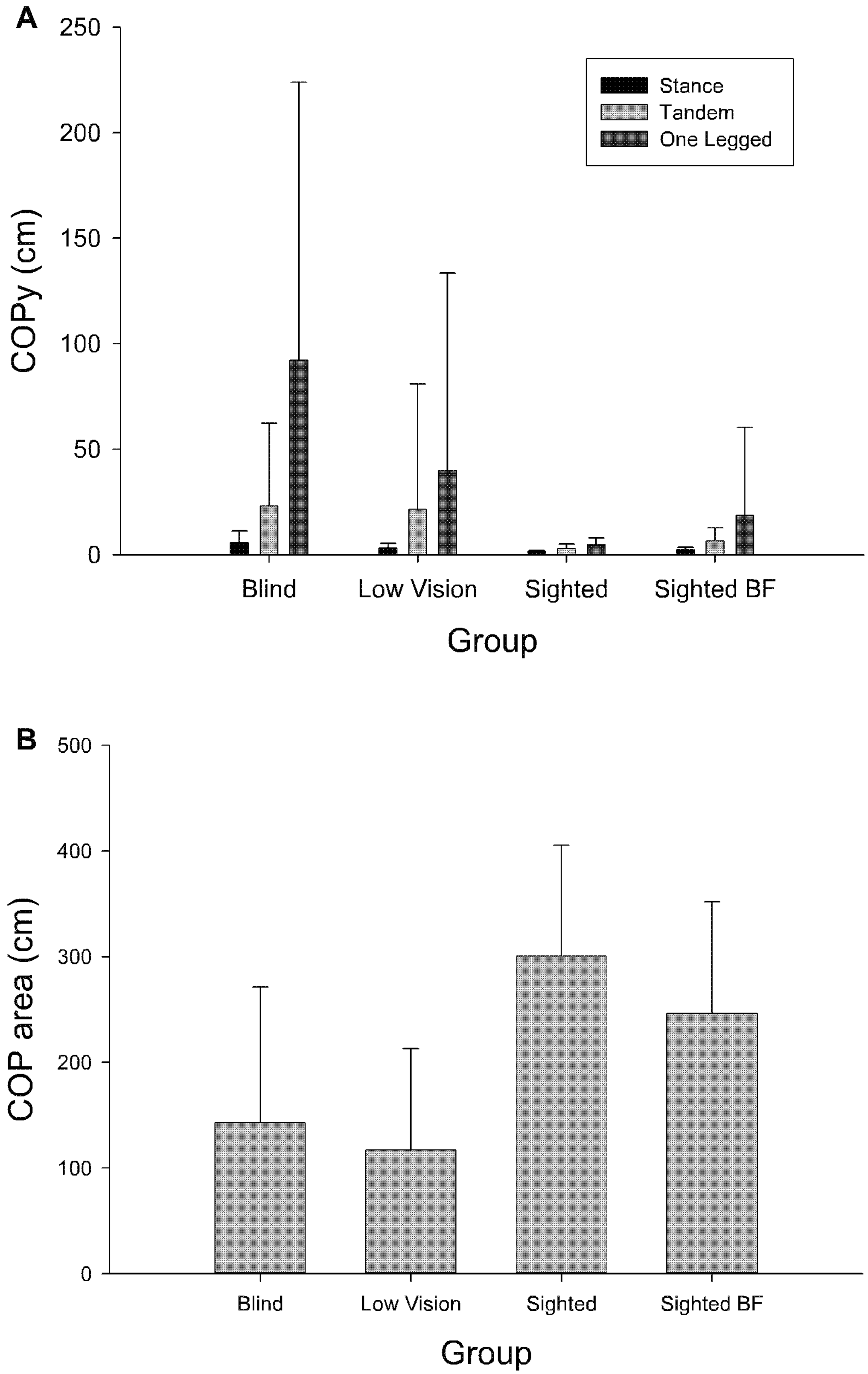

Figure 2. *(A) COP motion in the anteroposterior direction for Conditions 2 to 4. (B) COP area for the stability boundaries for each group: blind, low vision, sighted, and sighted blindfolded (BF).*

tasks such as climbing stairs, one rating for with a guide and another rating for without a guide. The rating for without the guide was generally one to two points lower than with a guide.

Table 1 displays the descriptive statistics for the self-efficacy survey. A main effect was found for the questions, $F(16, 67) = 9.16$, $p < .05$. When all groups were averaged, self-efficacy scores were

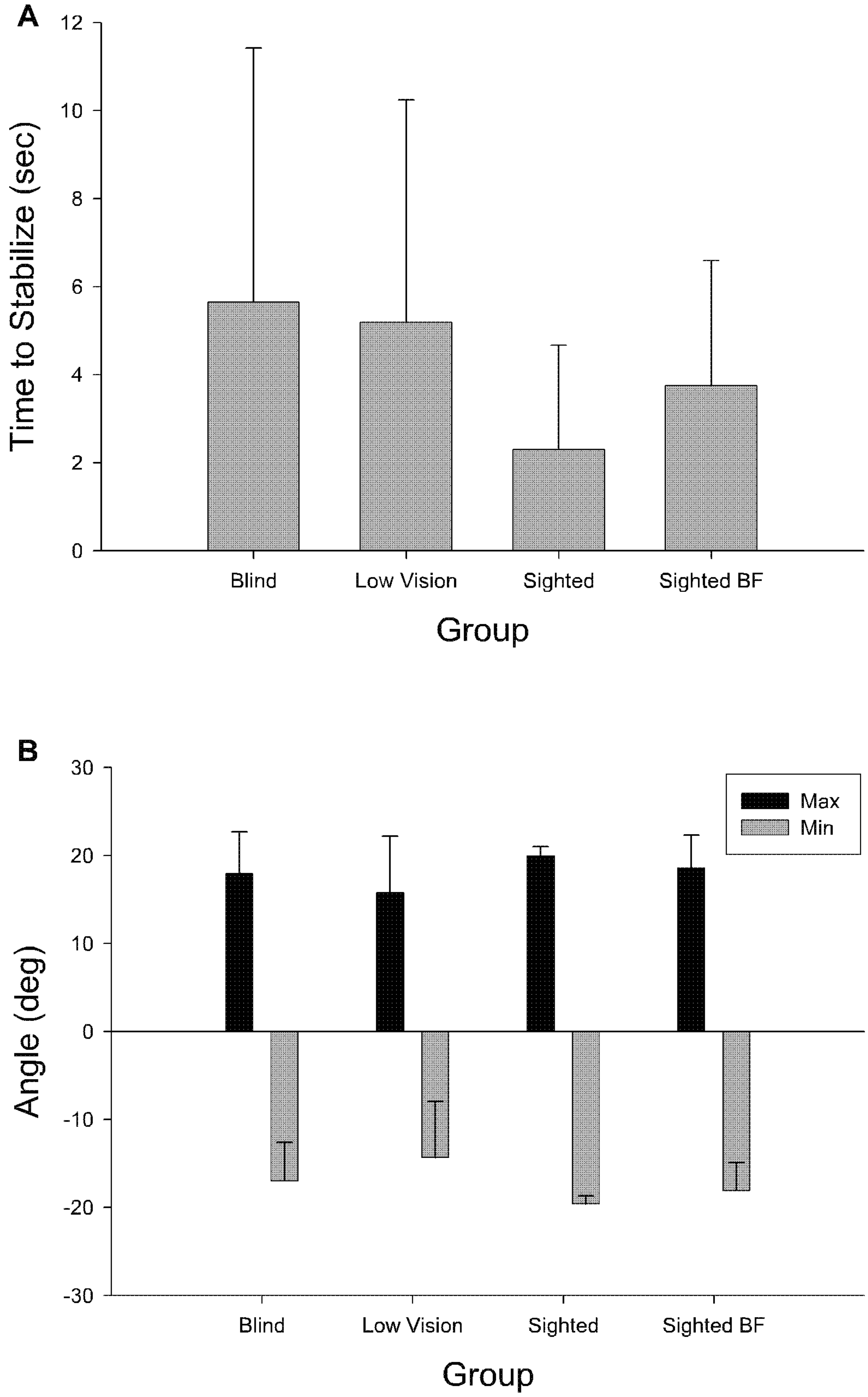

Figure 3. *(A) Time to stabilize on the stability platform during Condition 5. (B) Maximum and minimum excursions during Condition 6.*

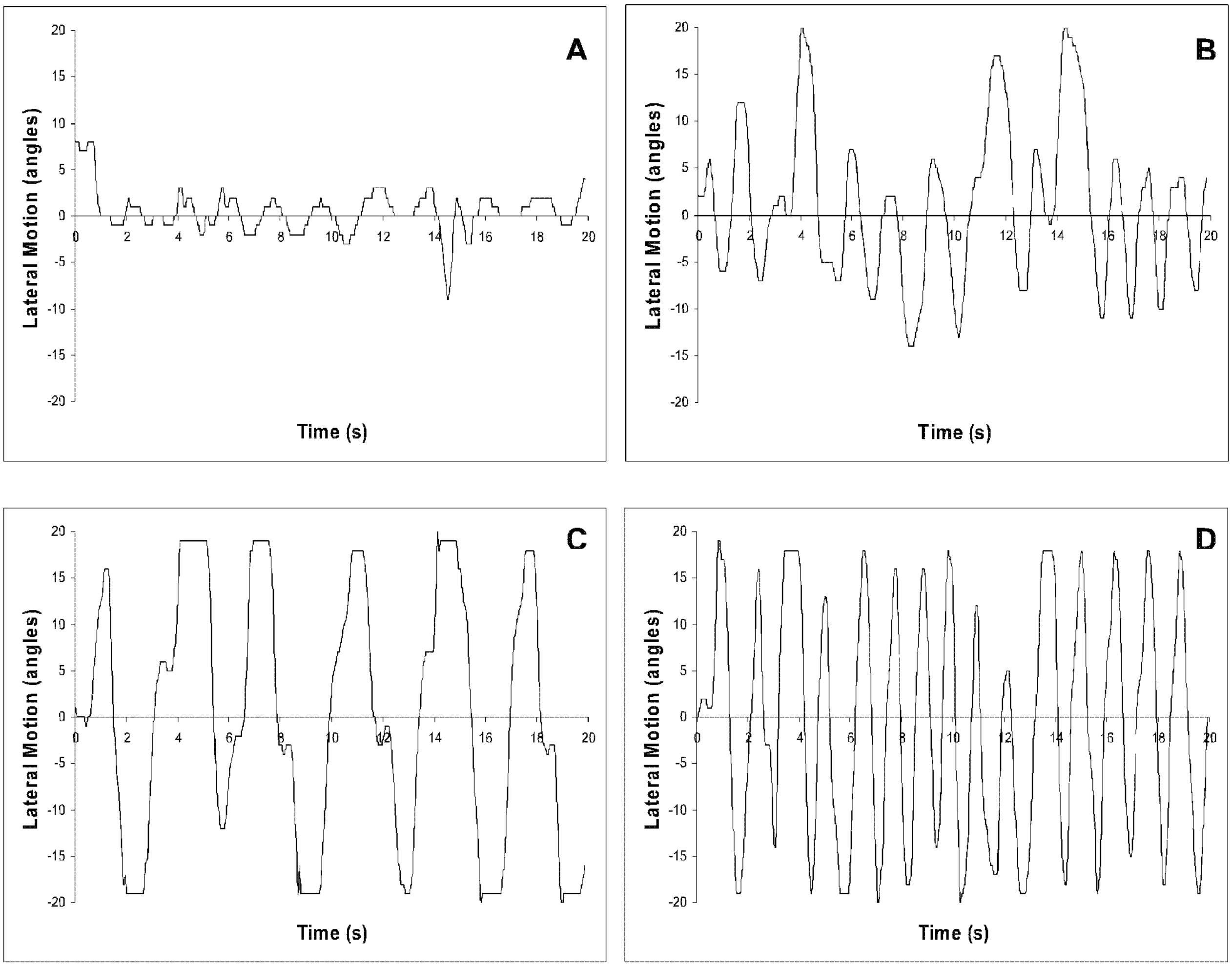

Figure 4. *Lateral motion on the stability platform during task of completing maximum motion from exemplar data plots of one participant per group. (A) Blind. (B) Low vision. (C) Sighted blindfolded. (D) Sighted.*

lowest for walking on icy sidewalks ($M = 3.3$) and the most confident for walking around the house ($M = 5$). There were significant differences across groups for some of the questions on the more challenging tasks. B rated themselves lowest for the walk in crowd/bumped ($M = 3.09$), stand on chair to reach ($M = 3.18$), and walk on icy sidewalks ($M = 3.18$) questions, with several individual participants rating themselves as a zero. S rated themselves as a mean of 4.81 for walk in crowd/bumped, 3.72 for stand on chair to reach, and 3.55 for walk on icy sidewalks.

Correlations

The third purpose of this investigation was to examine the correlations between static and dynamic balance and self-efficacy of balance within each group. Although no significant correlations were found for the mean scores on the self-efficacy questionnaire ($ps > .05$), there were significant correlations for some of the questions regarding more challenging activities. Some of these findings include, walking in a crowd/bumped was negatively correlated ($r = -03.94$, $p < .01$) for COP area and near significance for COPy ($p = .053$) for the standing still condition, and standing on a chair was negatively correlated with COP length ($r = -0.359$, $p < .05$) and COPy ($r = -0.354$, $p < .05$) for the tandem stance, and walking on icy sidewalks was positively correlated with maximum motion on the stability platform ($r = 0.342$, $p < .05$). These results indicate that the participants are better able to perceive their balance capabilities during more challenging tasks, but may overestimate their abilities during tasks that appear less challenging.

Discussion

This study aimed to expand upon existing research on static and dynamic postural control in

Table 1. Descriptive Statistics for the Self-Efficacy Balance Ratings

	Sighted		Low Vision		Blind	
	Mean	*SD*	Mean	*SD*	Mean	*SD*
1. Walking around the house	5.00	0.00	5.00	0.00	5.00	0.000
2. Up and down stairs	4.55	0.69	4.73	0.65	4.82	0.603
3. Pick up pencil from floor	4.55	0.93	4.23	0.88	4.73	0.905
4. Reach at eye level	4.55	0.69	4.64	0.92	4.45	1.036
5. Reach on tiptoes	4.64	0.50	4.36	0.92	3.82	1.834
6. Stand on chair to reach	4.82	0.40	3.64	1.75	3.18	2.228
7. Sweep the floor	4.55	0.82	3.55	1.81	4.09	1.514
8. Walk outside to nearby car	4.73	0.47	4.64	0.67	4.82	0.405
9. Get in/out of car	4.82	0.40	4.91	0.30	4.82	0.603
10. Walk across parking lot	4.82	0.40	4.41	0.86	3.73	1.954
11. Up and down ramp	4.82	0.40	4.82	0.60	4.73	0.905
12. Walk in crowd/bumped	3.73	1.01	3.82	0.98	3.09	2.023
13. Escalator holding rail	4.64	0.81	4.27	1.49	4.18	1.601
14. Escalator not holding rail	4.09	0.70	3.91	1.64	3.55	2.162
15. Walk on icy sidewalks	3.55	1.44	3.45	1.21	3.18	1.991
16. Dressing	4.91	0.30	5.00	0.00	4.82	0.603
17. Take a bath or shower	4.91	0.30	4.91	0.30	4.82	0.405

adolescents with and without visual impairments using a force platform and a stability platform. In addition to these assessments, this study examined balance self-efficacy in these participants and correlated this data with their balance performance. The results of the study supports previous research on adolescents with and without visual impairments in that sighted adolescents exhibit better balance than adolescents who are blind or have low vision (Bouchard & Tetrault, 2000; Sparto et al., 2006); however, it did not support the findings that sighted blindfolded adolescents performed worse than the adolescents with visual impairments (Ribadi et al., 1987).

Adolescents with visual impairments produced smaller stability boundaries and displayed increased postural motion during quiet stance, tandem stance, and one-legged stance. To obtain stability boundaries, participants were instructed to lean as far as possible in all directions of the horizontal plane without losing stability. Reduced COP area during the stability boundary condition is an indication of reduced postural control. The results of this study found that the stability boundaries were significantly increased with vision and the experience of normal vision, as found by comparing SB with LV and B. The sighted groups were also better able to reduce their postural motion during the standing still conditions under various levels of difficulty, also indicating that the experience of vision assisted the participants in adapting to the challenging tasks when blindfolded. In addition to increased COP motion during Conditions 2 to 4, many of the participants with visual impairments heavily relied upon the use of the upper body in an effort to maintain stability.

Like previous research findings, clear and conclusive differences between the varying levels of visual impairments on static (Houwen et al., 2007; Houwen et al., 2008) and dynamic balance (Ribadi et al., 1987; Wyver & Livsey, 2003) were not found in the present study. When comparing the two groups of adolescents with visual impairments, low vision and blind, there were trends toward LV performing better than B, but significant differences were only found for some of the COP measures. No significant differences were found between the two groups with visual impairments for any of the stability platform measures.

For the dynamic balance tasks, both groups of adolescents with visual impairments required more time to reach a stable position (Condition 5) and did not produce as much angular platform tilt (Condition

6) while on the dynamic platform than adolescents with sight but did not significantly differ between one another. Of particular interest, the groups did not significantly differ on the frequency of lateral movements during the maximum motion condition but did significantly differ on the amplitude of motion. Through observation of the adolescents completing the dynamic stability tasks, it appeared that the adolescents with visual impairments were freezing their degrees of freedom (constraining their joints and limiting their movement) while oscillating on the stability platform in an effort to simplify the challenging task. The sighted adolescents likely utilized more degrees of freedom allowing for better postural control as exhibited by large platform tilts and high lateral oscillation frequency. Vereijken, van Emmerik, Whiting, and Newell (1992) found that when placing novices on a ski simulator, they initially oscillated with low amplitude and high frequency. After much practice, performers were able to increase their amplitude of motion while maintaining high frequency of oscillations. It is probable that with additional practice, the adolescents with visual impairments would release their degrees of freedom enabling them to increase their magnitude of motion, which would further indicate improvement in both balance and postural control.

Although a strong relationship between self-esteem and motor performance has been found (Holbrook & Koenig, 2007; Willoughby & Polatajko, 1995), in these investigations there were only a few significant correlations found for some of the self-efficacy questions and the balance measures. In general, adolescents have fairly accurate when rating their capability to perform an activity (Damon & Hart, 1982), but it is possible that the participants in this study had a higher self-efficacy related to balance due to their participation in a sports camp. These participants may have considered themselves as athletes, which could have caused them to increase their self-efficacy ratings. These results indicate that LV and B were quite confident in their balance, rating themselves at a 4 or 5 level on many of the less challenging activities. It is important to note, however, that there was greater variability in the balance self-efficacy responses for B than S or SB, revealing that more of the adolescents who were blind were less confident than the sighted adolescents. Significant differences were found depending on the types of questions, indicating that many participants were aware of reduced balance abilities during more challenging tasks. All groups rated their stability highest while walking around the house and lowest while riding an escalator not holding onto the rail and while walking on icy sidewalks.

In summary, vision and experience with vision were significant factors in all of the balance assessments but not the self-efficacy ratings. Vision conferred an advantage for the balance measures, as expected, but sighted blindfolded adolescents also performed better, an unexpected finding. It was expected that the experience without vision would provide the adolescents with low vision and blindness an advantage in performing the activities over the sighted blindfolded participants. The results, however, indicate the opposite, that the experience of vision assisted the participants in adapting to the challenging tasks when blindfolded. Although there were no significant effects for the self-efficacy ratings, it is important to evaluate individuals with visual impairments on a variety of tasks and in a variety of contexts, examining both motor performance and self-efficacy. A high self-efficacy of performance is an important indicator of an individual's eagerness to engage in physical activities, both functionally and recreationally (Ray et al., 2007; Stuart et al., 2006; Vellas et al., 1997). Inactive adolescents are more likely to experience reductions in the maintenance of balance, which can make even functional activities difficult to perform. Self-reports of an individual's own abilities in addition to movement assessments have been reported to increase the involvement of an individual's treatments, which have been suggested to improve the effectiveness of the treatment (Berry & West, 1993). When evaluating overall motor function and competence, the most effective intervention is one in which involves the child or adolescent such as examining both balance self-efficacy and actual balance ability.

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