Teaching Dynamic Balance to Promote Skill Acquisition and Prevent Injuries in PK-6 Grades

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Who is Andrew Shim?

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Partnerships

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Objectives

1) Identify the etiology of falls

2) Understand the physiological and neurological issues that contribute to losing balance

3) Differentiate facets from fiction from current strategies being implemented on improving balance for children

4) Assess fall risks through using simple tests or through the power of observation
Nationwide Statistics

• Nationally, 2.3 million children are sent to the emergency rooms due to fall related injuries every year.
• In 2015, 90 children, ages 0 to 17 years, died of fall-related injuries (0.12 per 100,000) in the United States (2018 Child Fatality Report).
• A fall is an unintentional act of landing on the ground
• Falls cause brain injuries, permanent disability, and long term hospitalization
• A stigma still exists that it is normal for children to fall (Shim, Norman, & Kim, 2013.)
State of Nebraska

• According to Nebraska Health and Human Services Vital Records, unintentional injuries are the leading cause of death for children in NE
  • 7.5 per 100,000 children (2012)
  • Falls were the #1 reason for hospitalization in children and the #1 cause of non-fatal injuries
  • Many falls do result in severe injuries and represent a financial burden upon health care professionals and undue stress of parents or guardians (Shim et al., 2013).

Nebraska’s 2015 MCH/CSHCH Needs Assessment
Factors that contribute

• Unintentional falls are due to:
  – Individual behaviors of the child
  – Physical environment
  – Social behavior
  – Lack of supervision
  – Lack of motor skills*
Current Prevention Efforts

• Modifications of the environment
• Product safety
• Policies
• Legislation
• Education for behavior change *
Supervision
CNS Descending Pathway

- Corticospinal tract
- Motor signals from cerebral cortex for limb movements
- Decussation in medulla forms lateral tract
  - anterior tract uncrossed
- Tectospinal, reticulospinal & vestibulospinal tracts maintain posture & balance and provide reflex movements of the head
Balance and Postural Sway

• The incidence of falls increase with age (Payne, 2012)
• **Balance** is the process of automatic control that is developed during childhood and tends to regress in older adulthood
• Maintaining balance becomes more of a conscience effort as we age
  – CSM’s Human Performance/ Motor Behavior Labs are studying this to determine its role

Courtesy of CSM KES Human Performance Lab
What is Postural Sway?

- Postural sway is a nearly imperceptible back and forth motion designed to assist the body in maintaining upright or standing position.
Balance and Postural Sway

• Postural sway is gradually refined during childhood.
• During the 6th decade, a gradual deterioration is seen.
• By age 80, postural control may look like that seen in children between the ages of 6 and 9 years.

Rhino Shim, age 10 [courtesy of Andrew Shim]
What is Proprioception?

• This is your body’s ability to receive sensory information without visual references.

• Signals derived from various sensory endings, that is, proprioceptors, in response to mechanical deformation are transformed into electrical impulses that are represented at both conscious and unconscious levels of the CNS.
Sensory Integration Enhancement

• Sensory Integration (SI) is a brain process that occurs in all of us. Those that we know and those that are hidden.

• The senses that are the most obvious are those of sight. The hidden senses are those of movement (vestibular or inner ear) and of body position sense.

• The hidden senses are regulators of our nervous system and help build the foundation for purposeful movement = **Proprioception**
Proprioceptive response from Cortex
Does the Use of Strider Bikes Improve Stability in Three to Five Year Old Children?

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Strider Bike I Study (2012)
Strider Bike II – ASD Study (2016)
Dynamic Balance Concept

- The World Health Organization declared, in their most recent position statement, a multi-faceted fall prevention program should be organized for children, based on research that is evidenced-based.
- Researchers (Shim & Norman, 2013) investigated preschool children who rode pedal-less bicycles on an uneven outdoor surface for four weeks, three times per week for twenty minutes.
- The results demonstrated improved dynamic balance scores in the experimental group, but no improvements in static balance scores over a period of 4 weeks when compared to a control group of similar aged children.
- While static balance activities and drills can be beneficial for developing equilibrium and proprioceptive improvements, not all fall data are based on static movements.
- Recently, a published study has shown that dynamic balance has a positive relationship with lower body power scores (Shim et al., 2018).
Motor Skill Progression

• When introducing jumping balance skills that are dynamic in nature to young children, it is important to start with basic drills and progress to challenging ones.
• First, have the child start with hopping on one foot at a short distance before progressing to a greater distance.
• Each hop should require the child to hold the stance statically before taking off again on the same foot and traveling to another spot.
• This will develop leg strength, power, and core stability as the child works on promoting good posture.
• Each attempt should have every child demonstrate good body position with a slight knee bend at the landing to engage the core muscles and enhance good posture before bending the leg again to hop to another target.
• The children should attempt to switch legs during each drill to incorporate both limbs and promote equal exposure to each side of the body.
• Once the child has mastered the hop on each foot and increased the distance, while maintaining good body equilibrium during the landing, increase the difficulty by hopping at a target behind instead of in front or to either side of their body (left or right).
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Incorporating Cognitive Skill Development

• Once the hop skill has been improved and proper form has been achieved, groups of children can be divided up by 3 or 4 participants per diagram (numbers and symbols can be placed in plastic protective coverings and taped to the gym or facility flooring).
• A set of index cards would have simple math problems using addition or subtraction.
• One child would hold the index card and read the math problem while the other would start at the appropriate marker and use one leg to hop and solve the math problem by placing their foot on the appropriate numbers and eventually landing in proper form with their knee slightly bent and their upper torso in an upright position.
• Once their foot is considered on the wrong number or they lose control of their footing, they must start over.
Sample Floor Diagram

Shim & Woodward, 2019
Safety Considerations

1. Allow the student to use shorter distance for the first time to get the feel of how to control momentum and how specific muscles must be engaged to accomplish the task.

2. Make sure each child has proper footwear before beginning the hops.

3. Always start with activities involving both feet (jumping) before progressing to one-foot activities (hopping).

4. Start with one student per diagram at a time to avoid collisions.

5. Encourage and monitor proper posture during the hop and landing to prevent injuries.

6. Teach beginning hip flexion to hip extension activities on a softer surface and with low velocity and height before progressing to a harder surface.

7. Children should be advised to slow down if they are feeling out of control or if they are about to fall.

8. Allow children to perform activities gradually while setting goals to improve their balance and improve the distance of each hop during the practice sessions. It is essential for the physical educator to teach proper technique and progressions for optimal physical development and for the prevention of injuries. (National Association for Sport and Physical Education, 2009).
References


