

Gait Compromises

Activity 2C

Objectives:

Using the procedure they learned in *Gauge Your Gait*, students will be able to:

- ◆ Generate a hypothesis to be investigated
- ◆ Design an inquiry investigation to test their hypothesis
- ◆ Determine the validity of his/her hypothesis by graphing and analyzing data collected
- ◆ Present and support their findings to the class
- ◆ Describe how medical conditions affect gait

Activity Description:

Students have investigated typical gait phases in *Mobile Marvin*, and *Gauge Your Gait* activities. In this investigation, students will research various conditions that can cause *gait compromises*. They will use their creativity and understanding of gait phases to devise methods of simulating a gait compromise. Students are not limited in the kinds of material used to simulate the gait compromise, but it is suggested that the following materials be on hand: Ace wrap, walkers, canes, crutches. They will then investigate the effect of their simulated physical impairments on gait.

Activity Background:

General:

Human *gait* is a person's manner or style of walking. The study of *gait* dates back to the Renaissance in terms of descriptive studies and the 1870's in terms of *kinematics* (mechanics of motion) study. Studies in gait analysis have resulted in the development of the *gait cycle* concept. Students investigated the gait cycle in the *Gauge Your Gait Lab* and should have some knowledge of the phases. The gait cycle has two components: the *stance phase* (when the subject's leg is on the ground) and the *swing phase* (when the subject's leg swings forward through the air). Although gait cycle can be analyzed beginning with any of its points, it is usually convenient to use the *heel contact* of one foot. When one stance phase and one swing phase have been analyzed, one gait cycle has been observed. The stance phase of gait can be broken down into five sections. It begins when the heel of the subject leg comes in contact with the ground (*heel contact*), and it then continues as the foot becomes flat (*foot flat*). The non-subject leg then begins to move forward (*mid stance*), the heel begins to lift off of the ground (*heel off*) and this phase is completed when the toe finally lifts off the ground (*toe off*). The *swing phase* of the gait can be broken down into three sections. It begins when the toe of the subject leg is lifted off the ground (*toe off*), it continues as the subject leg swings forward (*mid swing*), and is



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completed when the heel of the subject leg makes contact with the ground (*heel contact*).

Impairments affecting gait, should cause a *decrease in velocity and stride length* and an *increase in cadence*. Keep this in mind when interacting with groups and helping them analyze their observations.

Disease/condition Background:

- ***Sports injuries*** such as Anterior Cruciate Ligament (ACL) tear, broken leg, and sprained ankle: The students will need to immobilize the affected body part. They may also have to use some adaptive equipment to aid mobility (i.e. walker, cane, crutches)
- ***Parkinson's disease:*** This disease affects the body's ability to move by causing the person to drag his/her foot when walking. The person tends to shorten his/her pace over time. People with Parkinson's show signs of poor posture and of bending over. Other common symptoms include slow movements, dragging of feet, and trembling.
- ***Arthritis:*** Arthritis is a crippling disease causing pain, stiffness and swelling of certain joints. People with arthritis will have morning stiffness, swelling of the joints, limping, muscle weakness, motion limitations, and pain. There are two types of arthritis:
 - ***Rheumatoid arthritis - Autoimmune disease characterized by pain, stiffness, inflammation, swelling, and sometimes destruction of the joints.***
 - ***Osteoarthritis - Degenerative changes in bone and cartilage of one or more joints. These changes can cause progressive wearing down and distortion of joints.***
- ***Knee replacement:*** For the replacement of the knee, the surgery includes removing the damaged ends of the bones above and below the knee and replacing them with metal and plastic pieces. People recovering from knee replacement surgery will begin therapy by using a walker due to limited range of motion in the affected knee.
- ***Stroke:*** People who have had some types of stroke may exhibit *steppage gait*. Steppage gait characterized by difficulty walking due to problems in flexing the foot on the affected side. This will cause the person to have difficulty moving that limb upward. It can be characterized by a foot-drop, where the foot hangs and the toes point down, causing toes to scrape the ground while walking. An exaggerated knee-raising motion may be noted to compensate for the dragging of the foot.
- ***Cerebral palsy (CP): Spastic gait*** is often seen in people with CP. This is characterized by a stiff, foot-dragging walk caused by one-sided, long-term, muscle contraction.
- ***Multiple sclerosis (MS):*** There are two gait abnormalities associated with MS. In *scissors gait* the person's legs may be



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flexed slightly at the hips and knees, giving the appearance of crouching, with the knees or thighs crisscrossing like scissors (person's legs cross over each other while walking). The other gait abnormality is *spastic gait* which is characterized by a stiff, foot-dragging walk caused by one-sided, long-term, muscle contraction.

- **Neuropathy:** Neuropathy is a painful condition in which motor nerves are damaged causing muscle weakness, cramps, and spasms. Loss of balance and coordination may also be observed.

Activity Materials:

- Meter stick
- 1 flat tray/pan
- Stop watch
- Calculator
- 2 pieces graph paper
- Basket
- Masking tape
- Dark-colored butcher paper (12 m)
- Talcum powder to fill shallow tray
- Data sheet (per group member)
- *Student Data Page* (per student)
- Mobility Compromise Cards
- Internet Access

Activity Management Suggestions:

- It is very likely that students will have relatives or friends with mobility compromises due to one or more of the conditions described in this activity (possibly some students are affected themselves). Student confidence and/or ability to discuss their condition will vary. Some students may be more sensitive or self-conscious. **It may be beneficial to discuss the assignment with affected students before beginning the lesson.**
- Allow students to work in groups of four, using the task cards from the *Gauge Your Gait Lab*.
- **Copy** cards with *the impairments listed and have each group* choose a card from a basket. This makes the determination of topic assignment more fun and more acceptable to students.

Extension:

Allow students to further research gait compromises on the following website:

Medline Plus Website:<http://www.nlm.nih.gov/medlineplus/>

References Used:

Cooke, Francis W., Friis, Elizabeth A, Lucas, George L. (1999).

A Primer of Biomechanics. New York: Springer-Verlag. Illustrated by Danielle Y. Chin

Whittle, Michael. (1991). Gait Analysis An Introduction. Oxford: Butterworth-Heinemann Ltd.

www.lifehome.com/SAFE009B.htm

www.fda.gov

www.hdonline.com

www.healthcentral.com/std/top/003199.cfm

www.emedicine.com/orthoped/byname/foot-drop.htm

<http://neurologychannel.com/neuropathy/symptoms.shtml>

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