Edinburgh Visual Gait Score (EVGS): Reference Guide

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Introduction

Three-dimensional gait analysis (3DGA) method has been commonly used for assessing pathological gait (Brown et al., 2008). However, assessing gait using 3DGA is not generally available in all clinics (Brown et al., 2008). The Edinburgh Visual Gait Score (EVGS) was developed and used to visually assess gait deviations for ambulatory children with cerebral palsy (CP). The test utilizes observational parameters of each major gait phase and event on coronal and sagittal video recordings (Read et al., 2003; Maathuis et al., 2005; del Pilar Duque Orozco et al., 2016). It consists of 17 observational parameters for each lower extremity that can be scored on a three-point scale (Read et al., 2003).

Establishing Author: Read HS, Hazlewood ME, Hillman SJ, et al. (2003)

Data Type: Ordinal

Measurement Type: Performance-based

Assessment Type: Observer/Video

Psychometric Properties

Reliability. The EVGS for cerebral palsy was validated for intra- and inter-observer reliability for observers experienced and inexperienced in gait analysis (Read et al., 2003; Ong et al., 2008; del Pilar Duque Orozco et al., 2016). However, the experienced observers generally have higher reliability than the inexperienced observers (Brown et al., 2008; del Pilar Duque Orozco et al., 2016).

Reliability in most articles was evaluated for complete agreement. The complete agreement for inter-observer reliability was found to be 60-90% and the kappa values were 0.18-0.85 for the all items of EVGS, while intra-observer agreement was 64-92% (del Pilar Duque Orozco et al., 2016). However, another study mentioned that the EVGS had excellent inter-observer reliability and poor intra-observer reliability (Mathuis et al., 2005). Reliability of the EVGS is higher for distal segments than for proximal segments (del Pilar Duque Orozco et al., 2016). Increased reliability also has a positive correlation to use with higher functioning patients (del Pilar Duque Orozco et al., 2016).

Validity. The validity (good to excellent) of the EVGS for cerebral palsy has been tested in several studies through comparison with 3D gait analysis (3DGA) data (Read et al., 2003; Brown et al., 2007; Ong et al., 2008; del Pilar Duque Orozco et al., 2016). In Read et al. (2003) and Ong et al. (2008), the total percentage of complete agreement for 10 out of the 17 EVGS was 64% for experienced observers, while the complete agreement presented 52% for inexperienced observers; thus, inexperienced observers showed a learning effect (Brown et al., 2008).

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Robinson et al. (2015) found that the EVGS had a strong correlation with the Gait Profile Score (r = 0.816) by analyzing retrospective data collected from 151 diplegic CP children (Robinson et al., 2015).

Required Resources

Time: 10-15 minutes

Personnel: 1-2 persons

Equipment:

- One or two video cameras (any smart phone or tablet will work)
- One or two height-adjustable tripods
- Measuring tape
- Masking tape
- Colorful dot stickers or reflective markers (less than 15 mm in diameter)
- Shorts for patient to wear
- Goniometer

Space: Walkway that is at least 8x4m

Cost: equipment only

Test Administration

Set up one of the cameras at the end of the 8m walkway track line to capture a coronal view. Place the second camera facing the center of the walkway to capture the sagittal view. The second camera should be set far enough away so as to capture the middle four meters of each trial. A patient should be able to complete two full strides in this distance. If only using one camera, set it up to capture the coronal view. Mark and record camera placement and height to ensure accurate replacement for each test condition. Place the stickers or markers on four anatomical landmarks of the patient's lower extremities (ie both ASIS's and greater trochanters). Adjust the cameras to be level with the height of the patient's greater trochanter. Record the patient walking back and forth along the walkway. The patient should be barefoot.

Open the video recordings in any video player software and take screenshots of each gait cycle event from both coronal and sagittal views. There are 17 observational parameters that should be measured (See Table 1). Each parameter is scored based on either observed condition or measured joint angles. A three-point scale is used for each parameter (See Tables 2 and 3). After scores have been assigned for each parameter, all scores should be summed.

TABLE 1. EVGS Observational Parameters
1. Initial Contact in Stance
2. Heel Lift in Stance

3. Max Ankle Dorsiflexion in Stance
4. Hind-foot Varus/Valgus in Stance
5. Foot Rotation in Stance
6. Foot Clearance in Swing
7. Max Ankle Dorsiflexion in Swing
8. Knee Progression Angle in Mid-Stance
9. Peak Knee Extension in Stance
10. Knee Position in Terminal Swing
11. Peak Knee Flexion in Swing
12. Peak Hip Extension in Stance
13. Peak Hip Flexion during Swing
14. Pelvic Obliquity at Mid-Stance
15. Pelvic Rotation at Mid-Stance
16. Peak Sagittal Trunk Position in Stance
17. Maximum Trunk Lateral Shift

TABLE 2. EVGS Three-point Scale

Ordinal Scale	Condition/measurement
0	Normal (within +/- 1.5 standard deviations (SD) of normal mean)
1	Moderate deviation (between 1.5 and 4.5 SD of normal mean)
2	Marked deviation (greater than 4.5 SD of normal mean)

TABLE 3. EVGS Parameters and Scores

Observational Parameter	Explanation	Score
1. Initial Contact in Stance	The heel normally contacts first. The toe describes that portion of the foot distal to the metatarsophalangeal joints. Simultaneous contact with the heel and toe comprises flatfoot contact.	• Heel contact: 0 • Flatfoot contact: 1 • Toe contact: 2
2. Heel Lift in Stance	If there is no heel contact during stance, there can be no heel lift (i.e., "No heel contact"). Heel lift normally occurs between opposite foot level and opposite foot contact ("Normal"). "Early" heel lift indicates that heel lift precedes the opposite foot being level with the stance foot. "Delayed" heel lift is present if heel lift occurs with or after opposite foot contact. "No forefoot contact" describes the rare occasion of a calcaneus foot when	• No forefoot contact: 2 • Delayed: 1 • Normal: 0 • Early: 1 • No heel contact: 2

	the forefoot does not contact during stance.	
3. Max Ankle Dorsiflexion in Stance	There is normal forward progression of the tibial over the planted hindfoot from slight plantarflexion at initial contact to dorsiflexion at terminal stance. Describe the maximum angle of dorsiflexion between hindfoot and shaft of the tibia during stance. In pathological gait, lack of heel contact may be caused by either excessive plantarflexion of the foot or excessive knee flexion. The tibial-hindfoot angle is therefore analyzed irrespective of the position of the foot on the floor.	• Excessive dorsiflexion (>40° df): 2 • Increased dorsiflexion (26°- 40° df): 1 • Normal dorsiflexion (5°- 25° df): 0 • Reduced dorsiflexion (10° pl - 4° df): 1 • Marked plantarflexion (>10° pl): 2
4. Hindfoot Varus/Valgus in Stance	In the coronal plane, the normal hind-foot is in neutral or very slight valgus.	• Severe valgus (more than 15° valgus): 2 • Mod valgus (6° to 15° valgus): 1 • Neutral/slight valgus (0° to 5° valgus): 0 • Mild varus (1° to 10° varus): 1 • Severe varus (more than 10° varus): 2
5. Foot Rotation in Stance	The normal foot is slightly externally rotated relative to the Knee Progression Angle (KPA, i.e., the direction in which the knee points during gait).	• Marked ext. >KPA (by >40°): 2 • Mod ext. >KPA (by 21°- 40°): 1 • Slightly more ext. than KPA (by 0°- 20° extension): 0 • Mod int. >KPA (by 1°- 25°): 1 • Marked int. >KPA (by >25°): 2

6. Foot Clearance in Swing	The whole foot including the toe should clear the foot and not make contact during swing phase. "None" should be recorded if there is continuous contact between some part of the foot and the floor throughout swing phase. "Reduced" indicates that there is a shortened but definite period of clearance during some part of the swing phase between the whole foot and the floor. "Full" or normal clearance is when the foot does not touch at all in swing; however, normal clearance is a very small amount. "High steps" describes excessive lifting of the foot from the floor. When there is reduced clearance followed by high stepping, circle both, giving a score of 2 for this combination of features.	• High Steps: 1 • Full: 0 • Reduced: 1 • None: 2
7. Maximum Ankle Dorsiflexion in Swing	The ankle is normally approximately neutral in swing, but very slight plantarflexion (5°) is acceptable.	• Excessive dorsiflexion (>30° df): 2 • Increased dorsiflexion (16°-30° df): 1 • Normal dorsiflexion (15° df- 5° pl): 0 • Mod plantarflexion (6°- 20° pl): 1 • Marked plantarflexion (>20° pl): 2
8. Knee Progression Angle in Mid-Stance	The knee normally points forward during gait. Record the position in which the knee appears to point during most of the stance phase. When either internal or external rotation is present but the whole knee cap is visible, score 1. When rotation is present to such an extent that the knee cap is partially out of	• External, part of knee cap visible: 2 • External, all of knee cap visible: 1 • Neutral, knee cap midline: 0 • Internal, all of knee cap visible: 1 • Internal, part of knee cap visible: 2

	view (external or internal, part cap visible), score 2.	
9. Peak Knee Extension in Stance	The knee approaches full extension in terminal stance. In pathological gait, the knee may remain more flexed throughout stance. Alternatively, hypertension can occur as femoral progression proceeds over an arrested tibia.	• Severe flexion (>25°): 2 • Mod flexion (16°- 25°): 1 • Normal (0°- 15° flexion): 0 • Mod hyperextension (1°- 10°): 1 • Severe hyperextension (<10°): 2
10. Knee Position in Terminal Swing	The knee is normally in slight flexion immediately before heel strike.	• Severe flexion (>30°): 2 • Mod flexion (16°- 30°): 1 • Normal (5°- 15° flexion): 0 • Mod overextension (4° flexion- 10° extension): 1 e • Severe hyperextension (>10° extension): 2
11. Peak Knee Flexion in Swing	The normal range is 50° to 70°.	• Severely increased (>85° flexion): 2 • Moderately increased (71°- 85° flexion): 1 • Normal (50°- 70° flexion): 0 • Mod reduced (35°- 49° flexion): 1 • Severely reduced (<35° flexion): 2
12. Peak Hip Extension in Stance	The hip normally extends in stance to between neutral and 20° of extension.	• Severe flexion (>15° flexion): 2 • Mod flexion (°1- 15° flexion): 1

		• Normal (0°- 20° extension): 0 • Mod hyperextension (21°- 35° extension): 1 • Marked hyperextension (>35° extension): 2
13. Peak Hip Flexion during Swing	Normal flexion is between 25° and 45°.	• Marked increased flexion (>60° flexion): 2 Increased flexion (46°- 60° flexion): 1 • Normal flexion (25°- 45° flexion): 0 • Reduced flexion (10°- 24° flexion): 1 • Severely reduced (<10° flexion): 2
14. Pelvic Obliquity at Mid-Stance	The pelvis normally drops slightly on the opposite side during loading, becoming level by terminal stance. Estimate the position in mid stance. "Up" and "down" refer to the position of the ASIS on the stance side, relative to the opposite side ASIS.	• Marked down (>10°): 2 • Mod down (1°- 10°): 1 • Normal obliquity (0°- 5° up): 0 • Mod up (6°- 15°): 1 • Marked up (>15°): 2
15. Pelvic Rotation at Mid-Stance	In mid stance, the pelvis should be at approximately neutral rotation, between 5° backward rotation (retraction) of the stance leg, and 10° forward rotation (protraction).	• Marked retraction (>15°): 2 • Mod retraction (6°- 15°): 1 • Normal (5° retraction- 10° pro): 0 • Mod protraction (11°- 20°): 1 • Severe protraction (>20°): 2
16. Peak Sagittal Trunk Position in Stance	The trunk is erect during stance and swing phases.	• Marked forward lean (> 15° forward): 2 • Mod forward lean (between 6° and 15° forward): 1

		• Normal upright (vertical to 5° forward or backward): 0 • Mod backward lean (>5° backward):1
17. Maximum Trunk Lateral Shift	Normally the trunk displaces laterally approximately 25 mm during stance, towards the stance leg. "Excessive" thoracic shift laterally or lateral flexion should be considered when recording observations. "Reduced" describes those cases in which the trunk remains leaning over the swinging leg.	• Marked: 2 • Mod: 1 • Normal: 0 • Reduced: 1

Interpretation

The maximum total score per lower extremity is 34. A score that is lower than the maximum indicates less gait deviation (Read et al., 2003). Robinson et al. (2017) found that the minimal clinically important difference needed for the EVGS is 2.4. The EVGS is considered to be a supportive tool that allows evaluators to utilize quantitative data in addition to qualitative data (del Pilar Duque Orozco et al., 2016).

Limitations

There are two major limitations in the EVGS. First, it is difficult to examine the biomechanical orthotic treatment because some of the EVGS parameters were only focused on the joint kinematics. Also, the distance from which gait videos were taken should be decreased to better delineate when initial contact occurs and to obtain clearer observation of anatomical markers for measuring angles and distances.

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Outcome Measure

Edinburgh Visual Gait Score (EVGS)

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