Prosthetic Observational Gait Score – POGS

Explanatory Notes

The P&O clinical movement data software can assist you in calculating the Prosthetic Observational Gait Score (POGS) [1]. Use the on-screen measurement and drawing tools to help you to evaluate each item of the score and enter the results in the POGS pane on the left hand side of the screen. The software will then generate a POGS report, with illustrative images from the video if desired, in PDF format.

It is expected that most evaluations will be carried out for the prosthetic side only, however it may sometimes be useful to consider both sides in the evaluation.

Trunk

1. Arm Swing
Arms should swing symmetrically with an amplitude appropriate to the walking speed.

Score 1 for asymmetric arm swing and choose whether the ipsilateral or contralateral side is showing the greater swing amplitude.

Score 2 for absent or negligible arm swing bilaterally, even when this is due to the use of walking aids.

Causes include:
- Pain or discomfort.
- Poor balance/confidence in balance.

2. Vaulting in Stance
In normal gait the total vertical displacement of the head and trunk is around 2% of body height, [e.g. about 35 mm for a person who is 1.83 m (6 ft.) tall]. Vaulting presents as increased vertical motion of the head and trunk affected by plantarflexor activity.

Score 1 for moderate, e.g. the appearance of heel lift is negligible.

Score 2 for marked, e.g. the heel lifts visibly during mid-stance.

Causes of vaulting on the contralateral side:
- Prosthesis too long.
- Prosthesis functionally too long in swing, e.g. because TF socket too small or pistoning.
- Inappropriate swing phase dynamics of prosthetic knee.
3. **Lateral Trunk Lean/Side Flexion**
The subject flexes or tilts the upper body in the coronal plane. This would normally be a tilt to the prosthetic side.

*Score 1* for moderate, (e.g. displacement of the head up to, and in line with, the supporting foot).

*Score 2* for marked, (e.g. displacement beyond the supporting foot).

Possible causes include:
- Short prosthesis.
- Insufficient lateral support in socket.
- Socket set in abduction.
- Pain or discomfort, especially on lateral distal aspect of residual limb.
- Weak abductors.
- Abducted gait.

4. **Peak Sagittal Position**
The trunk should be close to upright throughout the gait cycle. A forward tilt in a TF or higher level amputee may indicate poor knee stability with the amputee contriving to keep the ground reaction force anterior to the knee.

*Score 1* if the line between hip and shoulder is inclined forward by less than 10°, or reclined backwards.

*Score 2* if this line is inclined forwards by 10° or more.
5. **Peak Hip Extension in Stance**

Judge this from the centre line of the thigh segment, (i.e. the centre line of the prosthetic thigh segment for TF patients). Do not try to account for flexion of the residual limb in the socket. Try to judge with respect to the pelvis rather than vertical. Peak extension for the normal hip is between 0° and 20°.

Score 1 for flexion between 1° and 15° and for extension of between 21° and 35°.

Score 2 for flexion >15° and extension >35°.

Causes of decreased peak hip extension include.
- Anteriorly tilted pelvis/lumbar lordosis.
- Hip flexion contracture.
- Insufficient initial flexion.

If decreased peak hip extension appears to be due to an anterior tilted pelvis, causes of this include:
- Insufficient initial flexion in TF socket.
- Insufficient support from anterior brim of TF socket.
- Weakness of hip extensors or abdominals.
- Hip flexion contracture.
- May be a strategy to protect against a potentially unstable knee.

6. **Peak hip flexion in swing**

As for peak hip extension in stance, judge this from the centre line of the thigh segment and try to judge with respect to the pelvis rather than vertical. Peak flexion for the normal hip is between 25° and 45° flexion.

Score 1 for flexion between 10° and 24° and between 46° and 60°.

Score 2 for flexion >60° or <10°.
7. **Peak extension in stance (including knee buckling)**
The normal knee shows a peak of extension in terminal stance of between 0° and 15° of flexion and is stable with the ground reaction force vector anterior to the knee.

**Score 1** for flexion between 16° and 25° (too much) and for extension between 1° and 10° (hyperextension).

**Score 2** for flexion >25° or extension >10°.

**Score 2** for TF patients exhibiting knee instability/buckling of the knee irrespective of peak extension.

Causes of knee buckling in TF subjects include:
- Prosthetic knee anterior to line of ground reaction force.
- Insufficient initial flexion of socket.
- Inappropriate dynamic response of foot.
- Hip flexion contracture or hip extensor weakness.

8. **Flexion in terminal stance and pre-swing (including dropoff)**
The normal knee commences a steady rate of flexion at around opposite foot contact and reaches about 30° of flexion by foot-off.

**For early flexion:**
**Score 1** when flexion is initiated a little earlier than opposite foot contact.

**Score 2** when flexion is initiated markedly earlier than opposite foot contact while the opposite knee is still extending.

**For late flexion:**
**Score 1** when flexion is initiated more than half way through pre-swing.

**Score 2** if initiation of flexion is around foot-off or later.

Causes of drop-off include:
- Dorsiflexion bumper too soft.
- Toe lever too short.
- Socket too far anterior in relation to foot.
9. **Peak Knee Flexion/Heel-Rise in Swing**

The normal knee shows a peak of flexion in initial swing of between 50° and 70°.

*Score 1* for moderate, (e.g. flexion between 71° and 85° is too much and for flexion between 35° and 49° is too little).

*Score 2* for marked, e.g. flexion >85° or <35°.

Abnormal knee flexion in TF subjects may also be observed as abnormal heel rise, in which the heel rises posteriorly by an abnormal amount in initial swing.

Causes of incorrect heel rise in TF subjects include:
- Prosthetic knee with wrong amount of friction control.
- Poorly adjusted extension aid.
- Consequence of a strategy to forcefully flex the hip in initial swing to ensure full knee extension at IC.

10. **Knee in Terminal Swing and at Initial Contact**

In TF subjects look for terminal swing impact. This is when the prosthetic shank decelerates rapidly when the knee joint reaches maximum extension at the end of swing, i.e. it bangs into the end stop. This may also be audible with some prosthetic knee mechanisms.

*Score 1* for moderate, for example the Impact is visible or audible but not markedly early.

*Score 2* for marked, e.g. the impact is visible and noticeably early, and audible if applicable.

*Score 1* if the knee is flexed between 15° and 25° of flexion.

*Score 2* if the knee is flexed by more than 25°.

Causes include:
- Insufficient friction control at knee.
- Too much tension in extension aid.
- In all subjects look at the knee at the instant of initial contact.
11. Step symmetry
Score 1 if there is a moderate difference between sides in either the timing or the length of the steps such that the longer step or swing time is up to 25% longer than on the other side.

Score 2 if there is a marked difference in which the longer step or swing time is 25% or more longer than on the other side.

12. 1st ankle rocker
Initial contact should be by the heel followed by a controlled motion of the foot to plantargrade and should be achieved comfortably in advance of opposite foot-off.

Too rapid progression to foot flat can sometimes be detected audibly and is known as foot slap.

Score 2 on the left for flat foot initial contact or heel contact with over rapid first rocker.

Score 2 on the right for prolonged first rocker in which the subject ‘rides on the heel’ so that progression to plantar grade is too slow.

13. Foot rotation at initial contact
The foot rotates, usually externally, during loading response. View in coronal plane and:

Score 1 for moderate rotation.

Score 2 for marked rotation, such that detail on the side of the shoe is easily seen.

Causes include:
- Inappropriate dynamic response of prosthetic foot, (e.g. plantarflexion.
- Bumper too stiff).
- Poor control of socket (especially for a new suction socket user).
14. **Width of base/lateral thrust**

The width between the centres of the heels should be less than 0.5 width of the pelvis.

*Score 1* if it is estimated to be between 0.5 and 1 times the pelvic width.

*Score 2* if it is estimated to be greater than the pelvic width.

Lateral thrust can be observed at the knee and appears as a sudden motion of the knee into adduction.

*Score 2* when lateral thrust is marked.

Causes of a wide base include:

- Prosthesis too long.
- Distal segment aligned valgus with respect to proximal.
- Pain or discomfort in the crotch area (TF).
- Contracted abductors of residual limb (TF).
- Poor balance/confidence in balance.

Causes of lateral thrust include:

- Foot positioned too far medially.
- Socket set in abduction.

15. **Circumduction in swing**

The foot follows a curved path in swing.

*Score 1* if apex of curve results in a distance between heels of 0.5 to 1 times the pelvic width.

*Score 2* if apex of curve results in a distance between heels of greater than 1 pelvic width.

Causes include:

- Limited range of knee flexion due to mechanical (TF) or physical causes (TT).
- Prosthesis too long.
- Prosthesis functionally too long in swing, e.g. because TF socket.
- too small or pistoning;
- Reluctance to flex knee in TF subjects due to poor confidence.
16. Swing phase whip
The plane of the swinging limb does not lie in parallel to the plane of progression.
Results in the foot appearing to flick laterally (lateral whip) or medially (medial whip).
Causes include:
- Knee flexion internally or externally rotated.
- TF socket rotating during gait cycle due to poor fit, or loose, weak musculature.
- Internally or externally rotated toe break line.

Reference