
**Prosthetics and orthotics —
Vocabulary —**

**Part 1:
Normal gait**

*Prothèses et orthèses — Vocabulaire —
Partie 1: Démarche normale*



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Foreword

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ISO 29783-1 was prepared by Technical Committee ISO/TC 168, *Prosthetics and orthotics*.

ISO 29783 consists of the following parts, under the general title *Prosthetics and orthotics — Vocabulary*:

- *Part 1: Normal gait*
- *Part 2: Prosthetic gait*
- *Part 3: Pathological gait*

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Prosthetics and orthotics — Vocabulary —

Part 1: Normal gait

1 Scope

This part of ISO 29783 establishes a vocabulary for the description of normal gait.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1

body load loading

force exerted by the foot upon the ground at any time during the stance phase due to gravity and the forward, sideways and vertical accelerations of the body mass

2.2

cadence

number of steps taken per unit of time in steps per second

2.3

double support

those two parts of the gait cycle when both limbs are in contact with the ground

NOTE The first of these (approximately 0 % to 10 % of the gait cycle) commences after initial ground contact (and ends as the contralateral limb commences initial swing) the second (approximately 50 % to 60 % of the gait cycle) commences at the beginning of pre-swing (and ends as the limb commences initial swing).

2.4

gait cycle

the sequence of actions of a lower limb usually taken from initial contact of the foot until the next initial contact of the same foot when walking or running

2.5

ground reaction force

reaction by the ground to the force exerted by the foot at any time during the stance phase

2.6

pelvic obliquity

alignment of the pelvis (moves upwards or downwards) in the coronal plane

2.7

pelvic rotation

alignment of the pelvis (moves forwards or backwards) in the transverse plane

2.8

pelvic tilt

alignment of the pelvis (anterior or posterior movement) in the sagittal plane

2.9

single support

that part of the gait cycle when only the limb under consideration is in contact with the ground

2.10

stance phase

that part of the gait cycle during which the limb is in contact with the ground

NOTE The stance phase is further described by reference to five sub-phases (see 2.10.1 to 2.10.5).

2.10.1

initial contact

sub-phase of the stance phase which commences at the instant of initial foot contact and ends when knee flexion and ankle plantarflexion commence

2.10.2

loading response

sub-phase of the stance phase which commences after initial contact and continues until full foot contact occurs

2.10.3

mid-stance

sub-phase of the stance phase which commences when the contralateral limb commences its swing phase and ends when the heel leaves the ground

2.10.4

terminal stance

sub-phase of the stance phase which commences when the heel leaves the ground and ends at initial contact of the contralateral limb

2.10.5

pre-swing

final sub-phase of the stance phase which commences with initial contact by the contralateral foot and ends when the foot loses contact with the ground

2.11

step length

distance (measured in the line of progression) between the point of initial contact of a foot and the point of initial contact of the opposite foot in successive steps in metres

2.12

stride length

distance between the point of initial contact of the same foot in successive gait cycles in metres

2.13

swing phase

that part of the gait cycle during which the limb is not in contact with the ground

NOTE The swing phase is further described by reference to three sub-phases (see 2.13.1 to 2.13.3).

2.13.1

initial swing

sub-phase of the swing phase which commences as the foot loses contact with the ground and ends when the limb achieves maximum knee flexion

2.13.2**mid-swing**

sub-phase of the swing phase which commences when the knee joint starts to extend and ends when the hip joint reaches maximum flexion

2.13.3**terminal swing**

sub-phase of the swing phase which commences when the hip joint reaches maximum flexion and ends when initial foot contact occurs

2.14**the (three) foot rockers**

method of describing the action of the ankle and foot during the stance phase

2.14.1**first rocker**

(from 0 % to 10 % of the gait cycle approximately) commences at initial foot contact and extends through the loading response sub-phase of the gait cycle

NOTE 1 Its purpose is shock absorption.

NOTE 2 During first rocker, the ankle plantar flexes under the eccentric control of the pre-tibial muscles with the heel acting as the fulcrum.

2.14.2**second rocker**

(from 10 % to 30 % of the gait cycle approximately) coincides with the mid-stance sub-phase of the gait cycle

NOTE 1 Its purpose is to control the position of the ground reaction force relative to the limb joints above.

NOTE 2 During second rocker, the tibia moves forward, with the centre of the ankle joint acting as the fulcrum, under the eccentric control of the ankle plantar flexor muscles.

2.14.3**third rocker**

(30 % to 60 % of the gait cycle approximately) commences when the heel leaves the ground and continues until ground contact is lost

NOTE 1 Its purpose is to accelerate the limb in preparation for the swing phase of the gait cycle.

NOTE 2 During the third rocker, the foot pivots over the fulcrum provided by the metatarsal heads as a consequence of the concentric contraction of the ankle plantar flexor muscles.

2.15**walking base****step width**

distance between the centres of the heels of each foot measured perpendicular to the line of progression in metres

2.16**walking speed**

average rate of linear motion of the body in the line of progression in metres per second

3 Description of the sub-phases of the gait cycle**3.1 General**

The motions of the pelvis and lower limb segments during each of the sub-phases of the gait cycle are described in 3.2 to 3.9 using the terminology specified in Reference [1], unless otherwise specified in Clause 2.

NOTE 1 The dominant pattern of motion is in the sagittal plane. However, important motion also occurs in the coronal and transverse planes.

NOTE 2 The time at which the sub-phases occur is expressed as a percentage of the gait cycle duration following the initial foot contact.

NOTE 3 All joint and body segment angles and all sub-phase durations are approximate.

NOTE 4 The pelvic position and motions described refer to the ipsilateral side.

NOTE 5 The terms “maximum” and “minimum” refer to the joint positions achieved during the gait cycle, and not the possible range of joint motion.

3.2 Initial contact — at 0 % up to 2 % of the gait cycle

a) Sagittal plane:

- during this sub-phase, the pelvis is tilted anteriorly by 5°, the hip joint is flexed by 25° to 30°, the knee joint is flexed by 0° to 5° and the ankle joint is in a near neutral attitude.

b) Coronal plane:

- the pelvis and hip joint are held in neutral alignment; the subtalar joint pronates to a neutral alignment.

c) Transverse plane:

- the pelvis is rotated forward to a maximum of 10° and the hip joint is externally rotated 10°.

3.3 Loading response — at 2 % up to 10 % of the gait cycle

a) Sagittal plane:

- during this sub-phase, knee flexion increases to 15° and ankle plantar flexes to 10° to 15° with the heel acting as the fulcrum until full foot contact occurs.

NOTE This action of the ankle is termed first rocker.

b) Coronal plane:

- the pelvis tilts obliquely upwards by 5° (as a consequence of the drop on the contralateral side) and the hip joint adducts; knee joint abduction increases minimally and the subtalar joint pronates 5°.

c) Transverse plane:

- the pelvis starts to rotate backwards and simultaneously the hip joint rotates internally.

3.4 Mid-stance — at 10 % up to 30 % of the gait cycle

a) Sagittal plane:

- during this sub-phase, the pelvis returns to a neutral alignment, the hip and knee joints extend to neutral, and the ankle joint dorsiflexes over a stationary flat foot to a position of 10° dorsiflexion.

NOTE This action of the ankle joint is termed second rocker.

b) Coronal plane:

- the pelvis returns to horizontal, the hip joint abducts and the subtalar joint further pronates.

c) Transverse plane:

- the pelvis continues to rotate backwards to a neutral alignment and the hip joint to rotate internally to neutral.

3.5 Terminal stance — at 30 % up to 50 % of the gait cycle

a) Sagittal plane:

- by the end of this sub-phase, the pelvis is once again tilted anteriorly by 5°, the hip joint is extended to its maximum of 10° to 15°, the knee joint is fully extended and the ankle joint has plantar flexed to a neutral position.

b) Coronal plane:

- the subtalar joint returns to neutral.

c) Transverse plane:

- the pelvis rotates backwards by 10° and the hip joint internally by 5° to 10°.

3.6 Pre-swing — at 50 % up to 60 % of the gait cycle

a) Sagittal plane:

- during this sub-phase, the hip joint moves from maximum extension to neutral, the knee joint flexes to a position of 30° to 35° and the ankle joint plantar flexes at a position of 20° of the plantar flexion.

NOTE The pivoting action of the foot at the metatarsal heads, which occurs through terminal stance and pre-swing, is termed third rocker.

b) Coronal plane:

- the pelvis tilts obliquely downwards by 5°, the hip joint abducts and the subtalar joint reaches its maximum position of supination.

c) Transverse plane:

- the pelvis commences forward rotation with corresponding external rotation at the hip joint.

3.7 Initial swing — at 60 % up to 70 % of the gait cycle

a) Sagittal plane:

- during this sub-phase, the thigh advances to a position of 20° of hip joint flexion; knee joint flexion reaches 60° and the ankle joint dorsi-flexes to a position of 10° of the plantar flexion.

b) Coronal plane:

- the pelvis starts to tilt upwards and the hip joint to adduct while the subtalar joint pronates to a position of slight supination.

c) Transverse plane:

- the pelvis continues to rotate forward and the hip joint to rotate externally.