Coordination Exercises

Introduction

The definition of coordination is the ability to execute smooth, accurate, controlled motor responses (optimal interaction of [muscle](https://www.physio-pedia.com/Muscle) function).

* Coordination is the ability to select the right muscle at the right time with proper intensity to achieve proper action.



* Coordinated movement is characterized by appropriate speed, distance, direction, timing and muscular tension.

It is the process that results in activation of motor units of multiple muscles with simultaneous inhibition of all other muscles in order to carry out a desired activity.

The [cerebellum](https://www.physio-pedia.com/Cerebellum) is the primary centre in the brain for coordination for movement and the ability to execute smooth accurate motor response.

For coordinated movements to occurs all the below systems are involved

* Cerebellum
* [Vestibular system](https://www.physio-pedia.com/Vestibular_System)
* Motor system.
* Flexibility and ROM.
* Deep [sensations.](https://www.physio-pedia.com/Sensation)
* [Vision.](https://www.physio-pedia.com/Sensation)

Components of Coordinated Movement

Coordinated movement is dependent on:



* Volition: is the ability to initiate, maintain or stop an activity or motion.
* Perception: in tact [proprioception](https://www.physio-pedia.com/Proprioception) and [subcortical](https://www.physio-pedia.com/Basal_Ganglia) centres to integrate motor impulses and the sensory feedback. When proprioception is affected it is compensated with visual feedback.
* Engram: A postulated physical or biochemical change in neural tissue that represents a memory. Research proved that high repetitions of precise performance must be performed in order to develop an engram.A 1980 study concluded "Thousands of repetitions are required to begin to form an engram and millions of repetitions are necessary to perfect it. Coordination is developed in proportion to the number of repetitions of an engram practiced just below the maximal level of ability to perform.

Types of Coordination

Motor coordination to complete a task a collaboration of three skills:

1. Fine Motor Skills
	* Require coordinated movement of small muscles (hands, face).
	* Examples: include writing, drawing, buttoning a shirt, blowing bubbles
2. Gross Motor Skills
	* Require coordinated movement of large muscles or groups of muscles (trunk, extremities).
	* Examples: include walking, running, lifting activities.
3. Hand-eye Skills
	* The ability of the visual system to coordinate visual information. Received and then control or direct the hands in the accomplishment of a task.
	* Examples : include catching a ball,sewing,computer mouse use.

Causes of Coordination Impairments

Uncoordinated movement or coordination impairment is known medically known as ataxia. There are a number of known causes for [ataxia](https://www.physio-pedia.com/Ataxia). They range from chronic conditions to sudden onset. However, most conditions will relate to damage or degeneration of the [cerebellum](https://www.physio-pedia.com/Cerebellum).

Coordinated movement requires a functioning cerebellum, spinal cord and peripharal nervous system. Diseases and injuries that damage or destroy any of these structures can lead to ataxia**.**

These include:

* [Traumatic brain injury](https://www.physio-pedia.com/Traumatic_Brain_Injury)
* [Alcoholism](https://www.physio-pedia.com/Alcoholism)
* [Infection](https://www.physio-pedia.com/Communicable_Diseases)
* [Neuropathies](https://www.physio-pedia.com/Neuropathies)
* [Spinal cord injuries](https://www.physio-pedia.com/Spinal_Cord_Injury)
* [Multiple Sclerosis](https://www.physio-pedia.com/Multiple_Sclerosis)
* [Parkinson's](https://www.physio-pedia.com/Parkinson%27s_-_Clinical_Presentation)
* [Stroke](https://www.physio-pedia.com/Stroke)
* [Transient Ischemic Attack (TIA)](https://www.physio-pedia.com/Transient_Ischaemic_Attack_%28TIA%29)
* Genetic ataxias eg [Friedreich’s](https://www.physio-pedia.com/Friedreich%27s_Ataxia%22%20%5Co%20%22Friedreich%27s%20Ataxia) ataxia and [Wilson’s](https://www.physio-pedia.com/Wilson%27s_Disease) disease
* [Cerebral Palsy](https://www.physio-pedia.com/Cerebral_Palsy_Introduction)
* [Brain Tumors](https://www.physio-pedia.com/Brain_Tumors)

**Toxins can also cause ataxia.**

These include:

* Alcohol (most common)
* Seizure medications
* [Chemotherapy](https://www.physio-pedia.com/Chemotherapy_Side_Effects_and_Syndromes) drugs
* Lithium
* [Cocaine and heroin](https://www.physio-pedia.com/Opiod_Use_Disorder)
* Sedatives
* Mercury, lead, and other [heavy metals](https://www.physio-pedia.com/Heavy_Metal_Poisoning)
* Toluene and other types of solvents[[4]](https://www.physio-pedia.com/Coordination_Exercises#cite_note-4)

Examples of Coordination Tests in the Upper Limb

In the following tests, you will be looking for signs of Intention tremors and Decomposition of movements or Dysmetria: in the form of hypermetria or hypometria

* Finger-to-nose test - The shoulder is abducted to 90o with the elbow extended, the patient is asked to bring tip of the index finger to the tip of nose.Finger to therapist finger: the patient and the therapist site opposite to each other, the therapist index finger is held in front of the patient, the patient is asked to touch the tip of the index finger to the therapist index finger.
* Finger-to-finger test - Both shoulders are abducted to bring both the elbow extended, the patient is asked to bring both the hand toward the midline and approximate the index finger from opposing hand
* Finger-to-doctor's finger test - the patient alternately touch the tip of the nose and the tip of the therapist's finger with the index finger.
* Adiadokokinesia or dysdiadokokinesia - The patient asked to do rapidly alternating movement e.g. forearm supination and pronation, hand tapping.
* Rebound phenomena - The patient with his elbow fixed, flex it against resistance. When the resistance is suddenly released the patient's forearm flies upward and may hit his face or shoulder.
* Buttoning and unbuttoning test.

Examples of Coordination Tests in the Lower Limb

* Walking along a straight line. Foot close to foot:In case of cerebellar lesion, there is deviation of gait
* [Rom-berg test](https://physio-pedia.com/Romberg_Test?utm_source=physiopedia&utm_medium=search&utm_campaign=ongoing_internal#contents): Ask the patient to stand with heels together. Swaying or loss of balance occurs while his eyes are open or closed.
* [Foot tapping test](https://www.physio-pedia.com/Lower_limb_motor_coordination): The subject sits on a chair with adjustable height so that the bilateral soles made contact with the floor, and the hip and knee joints flexed at approximately 90°. He/She moves his/her toes up and down repeatedly to tap the floor as fast and as vigorously as possible for 10 sec with the heels planted on the floor. The test is performed for both sides separately. The examiner counts the number of taps for each side.
* [Lower Extremity Motor Coordination Test (LEMOCOT)](https://www.physio-pedia.com/Lower_limb_motor_coordination) []](https://www.physio-pedia.com/Coordination_Exercises#cite_note-7): The subject sits on a height adjustable chair with their feet resting flat on a thin rigid foam, heels on the proximal target, and knees at 900 of flexion. Then, after a familiarization trial, he/she is instructed to alternately touch the proximal and distal targets placed 30 cm apart with their big toe for 20sec. The number of touched targets in 20sec is recorded for the motor coordination of the lower limb.





Lower Extremity Motor Coordination Test

Coordination Tests for Athletes / Everyday Sports Person

Many high level tests also exist to help assess and improve an athletes skills and performance e.g. Stick Flip Coordination Test; Wall-Toss Test; Block Transfer; Soda Pop Test; Plate Tapping; Light Board; Test Heel-to-knee test.

The below video shows an athlete going through a series of high end coordination tests

General Principles of Coordination Exercises Involve

1. Constant repetition of a few motor activities
2. Use of sensory cues (tactile, visual, proprioceptive) to enhance motor performance
3. Increase of speed of the activity over time
4. Activities are broken down into components that are simple enough to be performed correctly.
5. Assistance is provided when ever necessary.
6. The patient therefore should have a short rest after two or three repetitions, to avoid fatigue.
7. High repetition of precise performance must be performed for the engram to form.
8. When ever a new movement is trained, various inputs are given, like instruction(auditory), sensory stimulation(touch) ,or positions in which the patient can view the movement (visual stimulation) to enhance motor performance.

Physiotherapy - Therapeutic Exercises Used to Improve Coordination

There are many interventions that can be utilised to improve coordination, such as:

* [Tai Chi](https://www.physio-pedia.com/Tai_Chi_and_the_Older_Person)
* [Pilates](https://www.physio-pedia.com/Pilates)
* [Yoga](https://www.physio-pedia.com/Yoga)
* [Otago Exercise Program](https://www.physio-pedia.com/Otago_Exercise_Programme) and use of [Balance Boards](https://www.physio-pedia.com/Balance_Boards)
* Neuromuscular coordination exercises. Check out the advanced examples of these below.
* Proprioceptive Neuromuscular Facilitation. The below video shows PNF in use
* Neurophysiological Basis of Developmental Techniques
* Sensory Integrative Therapy
* Frenkel’s Exercises