A Human Gait Institute Publication

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**Common Terms Used in Leg Bracing**

A Layman’s Guide for those Considering Bracing Options

**This document draws on the experiences of those of us who continue to actively explore bracing options with the goal of improving the quality of life of those impacted by musculo- skeletal limitations. www.humangaitinstitute.org**

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# Foreword and Acknowledgments

Common Terms Used in Leg Bracing is a reference document produced by The Human Gait Institute in accordance with its Mission Statement, which states:

*The mission of the Human Gait Institute is to assist people in reaping the benefits of innovative lower extremity orthotic technologies by supporting and/or conducting research, by fostering education and training for orthotists in these technologies, and by providing resources to support patients who are considering or using these technologies.*

The ***Human Gait Institute*** (“HGI”) was organized April 11, 2008. It is a Colorado non-profit corporation. It has obtained tax exempt status under Section 501(c)(3) of the federal Internal Revenue Code.

HGI is governed by its five Board members who have a combined 150 years of wearing leg braces, buying over 35 different types of braces. The Board members have gone through the process of obtaining leg braces in some form over these years. They currently all use innovative bracing technology.

This reference document is intended to be copied for personal use only. No part of it can be sold for profit. However, donations to HGI to help defray the cost of the workbook are greatly appreciated.

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# Kinds of braces (orthoses) and where they fit on the body

A health service provider usually prescribes braces. Braces may look different from each other based on the materials used and their ability to stabilize the limb.

## Orthosis

An orthopedic appliance or apparatus used to support, align, prevent or correct deformities, or to improve function of moveable parts of the body. For example, a leg brace.

## FO—Foot orthosis

An insert in a shoe to address some foot alignment problems.

## AFO—Ankle Foot Orthosis—Short leg brace

A brace that supports/controls the ankle and foot, helps prevent foot drop and provides side-to-side support. It may come up to just below the knee.

## KAFO—Knee Ankle Foot Orthosis—Long leg brace

A brace that supports/controls the knee, ankle and foot and may come up to just below the hip.

## HKAFO – Hip Knee Ankle Foot Orthosis

A brace that controls and supports the hip, knee, ankle, foot and may come up as high as the waist.

## SMO—Supra Malleolar Orthosis

A brace that encompasses/supports/controls the ankle joint and part or all of the foot and just comes up above the ankle bones.

## KO—Knee Orthosis

A knee brace that just goes around the knee and has no support from the foot or ankle. One type of KO is a called a knee cage. KO’s are most often used by athletes. They usually are not effective if the calf muscle is reduced in size, thus allowing the brace to slip.

## Ankle brace

Either an AFO or an SMO.

## Knee brace

Either a knee cage, a KO or a KAFO.

## RGO—Reciprocal gait orthosis

A brace that encompasses both hips and provides stimulation for one leg to move forward when the opposite leg is in stance phase

## Powered exoskeletons

A device that provides support on the outside of the body and uses motorized assist powered by a system of motors or hydraulics.

# Parts of a brace (orthosis)

## Materials used

### Plastic

### Leather

### [Carbon](http://hittenberger.com/for-patients/glossary-of-terms#carbon)

Black light-weight rigid graphite fibers (cloth) used in the lamination process.

### Poly-pro

Carbon infused plastic

### [Fabric or Neoprene Orthosis](http://hittenberger.com/for-patients/glossary-of-terms#fabric-or-neoprene-orthosis)

Orthoses fabricated of cloth fabrics or neoprene as the primary materials in the design of the device.

## Uprights

Usually made with plastic, various metals, carbon fiber or a combination of the materials.

### Medial-on the inside of the leg.

### Lateral-on the outside of the leg.

### Posterior-on the back of the leg.

### Anterior-on the front of the leg.

## Straps

Secure the brace to the body, have flexible closures that are usually made of Velcro, leather, and/or fabric and can have laces or buckles above or at the ankle, the knee and/or the hip.

## Joints

Allow or control motion at the ankle, knee, and/or hip joints. May be on the inside of the leg or the outside or both. Some are electronically triggered; some can be set at a certain angle to move/not move; some are lockable; some are free motion.

## Footplates

Support the foot inside the shoe. They are of various lengths under the foot and may help keep the brace on the limb. May be made of plastic, carbon fiber, or various metals.

## Power sources

Such as batteries (usually lithium) or hydraulic assist mechanisms—Designed to assist the wearer to move when walking.

# Ways that braces are made and sold

## Off the Shelf—OFS (Pre-Fabricated Orthosis)

Fabricated for the average sized person and are usually only minimally adjustable. Can come in sizes small, medium, and large and for left or right foot.

## [Custom Fitted](http://hittenberger.com/for-patients/glossary-of-terms#custom-fitted) (Semi-Custom)

A premade sized device that is fit and/or modified to a patient. Semi-custom may be an off the shelf brace used as the basic structure with specific parts added that are custom made.

## Custom Designed

An individually designed, crafted, and fitted brace, made specifically to meet the unique needs of an individual. A custom brace usually requires casting and fitting before the brace is manufactured.

## Electronic

A custom-made brace that can include a motor, hydraulics, and other mechanical devices. Frequently use computer sensor input to assist with the wearer’s functioning.

## Mechanical Assist

Uses various mechanical principles, mechanical devices and energy storing/releasing materials, such as graphite and carbon fiber, to accomplish desired functions.

## [Stance-Control](http://hittenberger.com/for-patients/glossary-of-terms#stance-control)

Device with an adjustable brake mechanism to add stability to an orthotic knee joint.

## Tri-planar control

Controls the movement of a limb in all three directions or “straightens out the leg/foot”. Sometimes this requires corrective pressures at multiple places on the foot, ankle, leg to correct this movement:

* Up and down/forward (sagittal plane) – Example: the foot is in a dropped or not dropped position
* Side to side (coronal plane) – as in the ankle turning in or out or the knee bending in (valgus or knock-knee) or out (Varus or bow legged)
* Twisting toward or away from straight ahead (rotary) -- Example: foot/toes turning in (pigeon toed) or foot/toes pointing out, or the kneecap pointing inward or outward when the person is putting weight on that leg

When orthotists say they practice “tri-planar control,” they mean they use a three-point pressure system. They may usually do this to correct a problem only at one site, not at multiple sites simultaneously. Patients are encouraged to get clarification about which sites are addressed with tri-planar control.

## Dynamic Response

## A function of the leg brace that allows it to store energy and later release that energy to help “propel the wearer forward”. Part of this is also called “floor reaction” or “ground reaction” forces—this is why the main control at the knee should be in front of the leg instead of behind it.

## One mechanism that makes this dynamic response possible is a carbon fiber graphite construction that allows the brace to flex (bend) when weight is applied to it and then actively recoil back to its original position when the weight is released (the foot is lifted off the ground).

# Professionals related to the bracing industry

Please note that some states have licensure for orthotic and prosthetic professionals, and some do not.

## CPO

A prosthetist/orthotist that has board certification.

## CO

An orthotist that has board certification

## CP

A prosthetist that has board certification

## C.Ped

A pedorthist that has board certification

## Neurologist.

An M.D. or D.O. who specializes mostly in diagnosis and medical treatment of problems related to the nervous system.

## Orthopedic surgeon

An M.D. or D.O. whose specialty is the treatment of the musculoskeletal system using surgery as a means for doing so.

## Orthopedist

An M.D. or D.O. whose specialty is the treatment of the musculoskeletal system.

## Orthotist

Professional trained to design and fit braces for leg, arms, trunk, neck.

## Pedorthist

Professional who focuses on interplay between the foot and footwear, and usually can make foot orthoses. Specializes in modifying footwear and employing supportive devices to address conditions which affect the feet and lower limbs.

## Physiatrist

An M.D. or D.O. who specializes in the non-surgical treatment of the musculoskeletal system involving rehabilitation and physical medicine, including pain treatment.

## Physical therapist

Professional trained in treatment of many conditions of the body’s neuromuscular systems which may include strength, balance, range of motion and other functional skills.

## Podiatrist/DPM

A physician who specializes in medical and surgical treatment of the ankle and foot—usually treating nothing above the ankle.

## Prosthetist

Professional trained to make artificial legs, arms.

# Medical terms related to bracing

## Lower extremity

Includes hips, legs, knees, shins, ankles, feet, and toes.

## Upper extremity

Includes shoulders, arms, elbows, forearms, wrists, hands, and fingers.

## Muscle tone

Innate tension of muscles.

## Common abnormal muscle tones

### Spasticity

### Excessive tone due to a neurological condition causing increased muscle resistance to movement.

### Flaccidity

Decreased tone and decreased resistance to movement often described as “floppy.”

## Contracture

Limitation of normal joint motion.

## Positions of the lower extremities

### Abduction

Movement of a part of the body away from midline—at the hips, the thighs are spread apart causing the “splits.”

### Adduction

Movement of a part of the body toward the midline, for example, squeezing the thighs together rather than moving apart.

### Dorsiflexion

Position of the foot and ankle relative to the heel being lower than the toes in such a way that the toes point upward and toward the leg.

### Equinovarus

The foot turns inward and down in Varus and plantar flexion causing a “club foot.” (Has both plantar flexion and Varus.)

### Extension

The act of straightening an extremity or joint

### [Flexion](http://hittenberger.com/for-patients/glossary-of-terms#flexion)

The act of bending a limb or joint

### Hyperextension

Movement of the joint beyond straight so that it is beyond 180 degrees

### Plantar flexion

Bending the ankle in a downward position

### Pronation

The arch of the foot presses down and inward commonly called “flat foot.”

### Recurvatum

Hyperextension of the knee, also called “back knee.”

### [Rotation](http://hittenberger.com/for-patients/glossary-of-terms#rotation)

A circular or turning movement of a body part around its axis.

### Supination

A twisting of the foot so the body weight is on outside of the foot resulting in a high arch.

### Valgus

A condition that can apply to any joint but commonly applied to the ankle and the knee. In the knee, it often results in a “knock kneed” appearance.

### Varus

A condition that can apply to any joint but commonly applied to the ankle and the knee. In the knee, it often results in a “bow legged” appearance.

# Commonly used insurance terms

## DME Durable medical equipment

Insurance Company term that denotes medical equipment that can withstand repeated use, is expected to last a certain period of time and generally is not useful to a person with the absence of an illness or injury. Braces may be included as DME or can be categorized separately, depending on the insurance company.

## Prosthetic/orthotic items

Medicare category that covers braces and their replacement parts when ordered by a doctor or other health care provider enrolled in Medicare. The supplier must also be eligible to accept payment from Medicare.

## Preauthorization\*\*

Insurance company process that identifies an item that is covered by the insurance contract, in which it **agrees** to the medical necessity of that item and pays **some** portion of the cost.

## Precertification\*\*

Insurance company process in which it **guarantees** the payment of a **certain amoun**t toward the purchase of an item.

\*\*Note: Preauthorization and precertification are usually obtained by the provider. You may need preauthorization, precertification, or both.

# Some diagnoses that could benefit from bracing

|  |  |  |
| --- | --- | --- |
| Cerebral Palsy | Charcot-Marie Tooth | Guillain-Barre Syndrome |
| Multiple Sclerosis | Muscular Dystrophy | Nerve damage from injury or illness |
| Neuropathy | Painful joints | Peripheral neuropathy |
| Polio and its after-effects | Spina bifida | Stroke |
| Structural damage from injury or illness |  |  |

**Appendix to Definitions**

**Tri-planar Control:** control of movement of a limb in all three directions or “straightens out the leg/foot” – sometimes this requires corrective pressures at multiple places on the foot, ankle, leg.

* Up and down/forward (sagittal plane) – Example: the foot is in a dropped or not dropped position
* Side to side (coronal plane) – as in the ankle turning in or out or the knee bending in (valgus or knock-knee) or out (varus or bow legged)
* Twisting toward or away from straight ahead (rotary) -- Example: foot/toes turning in (pigeon toed) or foot/toes pointing out, or knee cap pointing inward or outward when the person is putting weight on that leg

When orthotists say they practice “tri-planar control,” by which they mean they use a three-point pressure system. They may usually do this to correct a problem only at one site, not at multiple sites simultaneously. There a few systems available that control in multiple sites. Clients are encouraged to get clarification about which sites are addressed with tri-planar control.

**Dynamic Response:** a function of the leg brace that allows it to store energy and later release that energy to help “propel forward.” Part of this is also called “floor reaction” or “ground reaction” forces—this is why the main control at the knee should be in front of the leg instead of behind it. Another mechanism that makes for dynamic response is the carbon fiber graphite construction that will allows it to flex (bend) when weight is applied to it and then actively recoil to its original position when the weight forces are released (the foot is lifted off the ground).