

Foot & Ankle Splints or Orthoses

*This Information Sheet has been written by **Chris Drake**, SRorth, Dip OTC, M.B.A.P.O. Chris is a State Registered Orthotist. This Sheet aims to answer your questions about foot and ankle splints – what they are, what they do and what the differences are between them.*

‘An Orthosis is an externally applied device used to modify the structural or functional characteristics of neuro-musculo-skeletal system’
Definition by the International Organisation for Standardisation (ISO)

What are they?

Ankle and foot splints or Orthoses have been used for many years to manage the walking pattern (gait) of hemiplegic children. They are used in preventing unwanted and uncontrolled movements associated with muscle imbalances and increased tone in the lower leg and the foot and ankle.

Posture problems in hemiplegic children

Abnormal movement in hemiplegic children usually means a tip-toe walking pattern (Equinus or Plantarflexed Gait) with the added complication of the ankle becoming twisted outwards (Varus ankle) or inwards (Valgus ankle). The adoption of a toe-walking gait also leads to secondary problems related to control of the knee which in many cases tends to snap backwards further than it would normally (Hyperextension). This in turn has an effect on hip position and a general reduction in the child’s balance. I am sure many parents will be familiar with this type of walking. As you would expect, a toe-walking gait pattern is undesirable as it has a detrimental impact on the child’s posture. It also increases the potential of fixed deformities of the ankle and knee occurring later in life.

How ankle and foot orthoses can help

One way of assisting in the prevention of this type of walking is with the fitting of a below-knee ankle/foot orthosis (AFO) which can control the movement of the foot and ankle and position it in a more normal alignment. A well made and close fitting AFO will control the unwanted movements in the foot and ankle and can also influence hip and knee position. This in turn can lead to a dramatic improvement in the child’s gait, balance and posture.

The history of orthoses

AFOs used to be made of traditional metal and leather and then fitted to a supportive boot or another type of footwear. These tended to be heavy, unsightly and ineffective in maintaining the correct alignment over a period of time. The advent of modern thermoplastics meant that lightweight full contact AFOs could be manufactured from a cast taken of the child's lower leg. This allows them to be fitted into the child's own footwear which means greater acceptance. The close fit of the thermoplastic AFO means improved control and greater effectiveness. At first they were made with a solid ankle complex which held the foot and ankle at 90° to the lower leg (Neutral plantargrade position). This prevented the foot and ankle from being pushed down (Plantarflexion) and subsequently prevented the development of a toe-walking gait.

What is Dorsiflexion and why is it important?

Unfortunately the traditional AFO also meant that the movement of the foot and ankle upwards was also lost. This movement is called Dorsiflexion and is vital for many daily activities and a smooth, progressive gait pattern. Dorsiflexion allows for many functions to be achieved easily without overstressing other joints. It also occurs in walking to help make it energy-efficient. Without dorsiflexion, gait tends to be jerky and stick-like as it is difficult for the body and leg to pass over the effected foot and ankle during walking. Dorsiflexion allows for many functions to be achieved easily without overstressing other joints. It also occurs in walking to help make it energy-efficient. Without dorsiflexion, gait tends to be jerky and stick-like as it is difficult for the body and leg to pass over the effected foot and ankle during walking. The fitting of a fixed AFO is very effective at preventing a toe-walking gait as well as sideways movements of the ankle (Valgus & Varus movements) but it will hold back the child's development by not allowing Dorsiflexion to occur.

Next time you are walking uphill, climbing or descending stairs, getting up from a chair or bending down to pick up your car keys, concentrate for a moment on your foot and ankle position. You will notice the importance of dorsiflexion in all these activities.

Why is a hinged AFO preferable?

The hinged AFO is in many ways very similar to the fixed ankle type. During the manufacture of the hinged AFO a simple mechanical joint is fitted at the level of the ankle axis and incorporated into the moulding. A backstop is also fitted behind the ankle which prevents plantarflexion. The finished hinged orthosis then allows the required amount of dorsiflexion to occur while preventing all plantarflexion past 90 degrees. The hinged AFO also provides medial and lateral stability of the ankle and therefore prevents valgus or varus positioning. The foot plate of the AFO can be made flat or contoured depending on the child's requirements. Hinged AFOs allow for a more natural, fluent gait, while allowing the foot and ankle to dorsiflex during other daily activities such as squatting or ascending/descending stairs.

Are AFOs always necessary for hemiplegic children?

There are times when the child's condition does not warrant the fitting of an AFO. They may not have the problems of a toe walking gait, but may suffer from general low tone or have some instability of the ankle joint complex. This can lead to problems of balance and a very wide base during walking. The ankle may also tend to fall into a varus or valgus position. When the back foot is held in a valgus position the arch of the foot tends to flatten along with it (overpronation). A varus back foot position tends to create a high arched foot (supination). In these cases of valgus ankle with overpronation or a varus ankle with supination, the fitting of foot orthoses can be helpful in reducing these unwanted foot and ankle positions and consequently improve balance and posture.

Different types of orthoses

The orthoses which can help with the problems of ankle and foot instability range from simple supportive footwear, footwear with adaptations to complex multi-material biomechanical and functional foot orthoses. Footwear alone has little effect over substantial foot instability, but is useful in offering improved stability of an unstable ankle when the child starts to walk. The special footwear has a wide, flat, good-gripping sole with increased stiffening around the ankle and this can help give the child a greater sense of balance. But be aware that the foot itself may still roll around inside the boot unseen and therefore careful fitting of the correct widths and types of boot is essential. Adaptations to the footwear, such as medial and lateral wedges, can help increase their control over unstable ankles. Foot orthoses can be incorporated into the footwear to improve foot stability and these usually come in the form of insoles with arch support and heel cups which are extended up around the heel but finish below the ankle. Both these types of foot orthoses may have special wedging (posting) fitted, either to the outside (extrinsic) or built into the orthoses (intrinsic) when manufactured. The posting or wedging is fitted to produce a correcting force on the heel when the child is weight-bearing or walking. These foot orthoses are usually made of lightweight thermoplastics and made from a cast of the child's foot in a corrected position.

It is important to note that the un-affected foot must also be examined and will probably need to have an orthosis fitted too. This may not be the same as the opposite leg and may only be a levelling insole but it will encourage symmetry and improve balance.

Supramalleolar Orthoses SMOs (orthoses which finish just above the ankle) or Dynamic Ankle Foot Orthoses (DAFOs) come in a variety of designs. They are very useful in improving medial and lateral stability around the ankle but offer little control over increased tone, dorsiflexion or plantarflexion. They are therefore ineffective at correcting a toe-walking gait and offer relatively little control of the foot and ankle during the swing phase of gait or when not bearing weight. They only stabilise the mid and hind foot when the child is standing or when the affected leg is in a weight-bearing position during walking (stance phase of gait). This must be taken into consideration when the child is assessed.

Whatever types of orthosis is recommended or fitted, they share many common design points and try to provide some or all of the features below:

- Provide hind foot stability (close moulding around heel)
- Provide mid-forefoot stability (medial & lateral extensions. good arch supported)
- Control unwanted exaggerated and abnormal movements
- Reduce the effects of increased tone (spasticity)
- Promote a stable base
- Encourage proximal stability
- Built in rear foot/forefoot wedging or posting (valgus or varus)
- Toe and Metatarsal support (tone management)
- Contoured sole plates to assist in foot stabilisation (reduce tone)
- Manufactured from: semi flexible or rigid materials (polypropylene, polythene etc)

Orthoses are never an answer in themselves but in many cases they are an extension of the therapist's arm while away from hands-on active treatment. The goal of orthotic management should be to provide the least amount of hardware possible to encourage and promote the child's own abilities in achieving a normal gait. It is important that assessment is carried out in a multidisciplinary environment to ensure that the correct orthotic prescription is made. Regular reviews must also be undertaken to ensure the continued effectiveness of the orthosis over time as the child develops and grows.

Although great care has been taken in the compilation and preparation of this leaflet to ensure accuracy, HemiHelp cannot accept responsibility for any errors or omissions. Any medical information is provided for education/information purposes – you should obtain further information from your medical practitioner.

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