

# PRODUCT OVERVIEW THE AMBULATORY ADM™

FOR PATIENTS WITH DYNAMIC SUPINATION AGED 1 TO 16 YEARS



ADM MODULAR BRACE SYSTEM

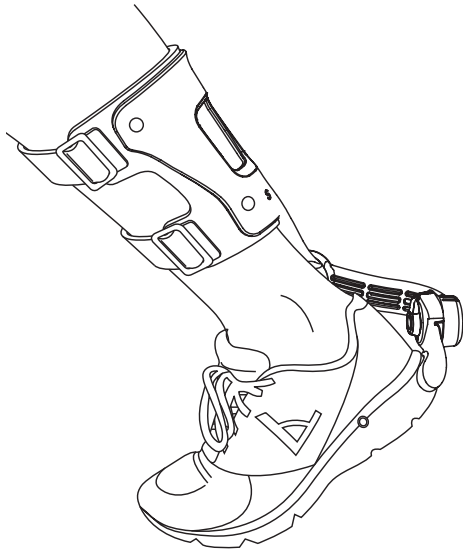


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## A Unique Bracing Option for Dynamic Supination

The Ambulatory Abduction Dorsiflexion Mechanism (ADM) comprises a standard ADM device used in conjunction with adapted ambulatory footwear.



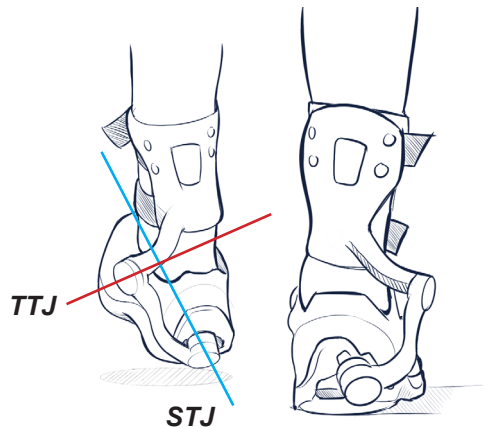
During ambulation the ADM works as a dynamic proprioceptive brace. It alters the users gait to encourage longer, more active strides with a clear medially biased heel strike and significantly reduced pressure on the lateral border of the foot.

The Ambulatory ADM benefits patients by breaking the cycle of worsening dynamic supination arising from an underlying foot condition. The brain naturally responds to limited ankle range of motion or control by altering the gait. Often this means the gait has a reduced stride length, inward rotation and that the heel strike is replaced by a mid or front foot strike. This type of gait is often described as *Dynamic Supination*.

As well as limiting mobility Dynamic Supination can lead to serious foot and ankle damage.

The ADM is the only ambulatory lower leg orthosis that simultaneously acts on both key ankle foot joints to encourage the triplane foot motions required during normal ambulation.

The ADM comprises two spring powered mechanisms aligned to the patient's Tibio-Talar Joint (TTJ) and Sub-Talar Joint (STJ). The combined motions of the ADM both model and encourage a natural foot motion.



*The ADM™ has a unique award winning design. No other brace can simultaneously rotate the foot about the Tibio-Talar (TTJ) and Sub-Talar (STJ) joints and model the complex triplane motions of the foot.*

## Gait Analysis

As an ambulatory orthosis the ADM modifies the patient's gait. Stride length is increased, heel strike improved and inward rotation decreased. The images below show a 9 year boy with bilateral clubfoot. The feet have been corrected, but remain very stiff and have limited range. The left foot relapse is evident.



**1. Initial swing phase:** The build-up of thickened and hardened skin on the lateral border of the foot indicates dynamic supination.

**2. Mid swing phase:** The ADM's STJ mechanism is correcting heel varus and simultaneously the TTJ mechanism is dorsiflexing the foot and acting to increase stride length

**3. Terminal swing phase:** There is a sharp contrast between the two images. Without the ADM the patient's mid-foot strikes the ground on the lateral border and stride length is short. When braced with an ADM there is a distinct toe-up medially biased heel strike. Stride length is increased and internal rotation replaced with external rotation.



Typical patient Centre of Pressure profile without ADM (Red line) and with ADM (Green line)

**Centre of Pressure (COP):** COP analysis illustrates how the ADM modifies the COP of a patient with a supinated gait to reduce pressure on the lateral border

The illustrations above clearly show how the ADM can address a gait with dynamic supination. A smart phone with a slow motion camera can be used to help observe a patients gait at home or in the clinic.

## Common Indications & Contraindications

The Ambulatory ADM is potentially beneficial to a diverse patient group affected by an array of disorders or trauma where the resulting condition is a supinated gait.

Typical indications include relapsing or partially relapsing clubfoot patients, including those returning to full mobility following surgery, such as an Anterior Tendon Transfer (ATT). The Ambulatory ADM may also be beneficial to patients with syndromic or acquired clubfoot arising from neurological and muscular disorders.

The Ambulatory ADM provides a complementary additional therapy for some clubfoot patients, but is not intended to be used as an alternative to night bracing.



Signs that a patient may benefit from an Ambulatory ADM include:

- Walking with excess pressure on the lateral border of their foot resulting in a build-up of thickened and hardened skin.
- Inward rotation of the whole foot, possibly from the hip or knee resulting in a shuffling gait style.
- Short stride length
- Prone to tripping or ankle injury and easily fatigued
- Toe walking

The ADM can be used as a preventative intervention on patients with difficult to treat clubfoot or a developing supinated gait.

The Ambulatory ADM is for patients from 18 months (10.5cm foot) of age to 16 years (25cm foot) able to walk and support themselves using normal or non-supporting orthopaedic footwear.

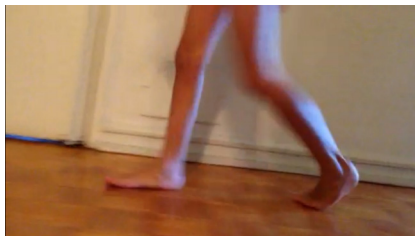
The Ambulatory ADM is not generally indicated for patients with more extreme difficulty walking requiring the assistance of a supporting AFO or frame to hold themselves upright.

*The Ambulatory ADM can be beneficial to patients with a range of disorders where the outcome is a supinated gait.*

## Anticipated Benefits

The Ambulatory ADM has the potential to provide both immediate and long term benefits to users. Immediate benefits can include gait improvements, which result in a more normal and comfortable looking gait without or with reduced characteristics of dynamic supination. Patients may report improved endurance, trip less and generally be more comfortable.

This young boy (left page) had well corrected clubfoot and good range, but was developing a supinated gait. The Ambulatory ADM was used to complement night bracing to help reinforce a more healthy gait with longer strides and a positive heel strike.



This eight year old boy (above) was born prematurely and diagnosed with diplegia. The right side had lower muscle tone and mass than the left. He can walk and run without assistance, but his gait has significant internal rotation and foot drop. He is prone to tripping and fatigue, especially at school, which impacts on his confidence. A variety of conventional AFOs have been tried, but they were felt to be overly restrictive and were not well tolerated. A right side ADM with standard TTJ and soft STJ springs resulted in significant improvements to his gait, mobility, balance, endurance and self confidence. The images above of him confidently enjoying playing soccer with his brother illustrate how the simultaneous motions of the two anatomically aligned ADM mechanisms permit normal foot motions whilst encouraging a much improved gait.

*The Ambulatory ADM can significantly improve balance, endurance and self confidence. Active outdoor play, climbing or using the ADM in potentially hazardous environments must be closely supervised by a responsible adult. Using the ADM in harsh environments or during sport will increase the risk of accidentally damaging the ADM device.*

# Patient Benefits

This eight year old boy suffered a stroke at 7 months of age and suffers from right side paralysis. He is ambulatory, but has foot drop and flatfoot. A variety of conventional AFOs have been tried, but were found to be difficult to use, restrictive of normal foot motion and were not well tolerated.



An ADM with standard TTJ springs and very soft STJ springs were used with footwear fitted with supporting insoles for the flatfeet. This combination was found to improve the gait and to be well tolerated. Independence and self confidence were important factors for the patient who found, unlike with conventional AFOs, donning and doffing the ADM possible. Footwear with hook and loop straps was selected due to significant paralysis to his right hand and arm.

## Longer Term Benefits

The Ambulatory ADM is capable of delivering immediate benefits to users in terms of improved gait, balance and endurance. In the longer term the Ambulatory ADM may help some patients to improve their unassisted gait. Weight bearing activity, with the feet positioned correctly, is especially helpful to children with a supinated gait; it encourages correct anatomical development, reduces hardened skin on the lateral border, promotes a better foot shape and improved range of motion. It may also help improve self confidence, promote enthusiasm for physical activity and reduce the risk of injury.

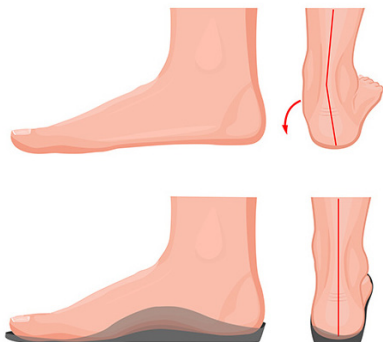


Ambulatory ADMs are generally well tolerated by users as they are less restrictive than conventional AFOs. A wide range of activities to be undertaken with confidence.

*Longer term benefits of Ambulatory ADM use may include improved foot shape, range of motion and improvements to the unassisted gait.*

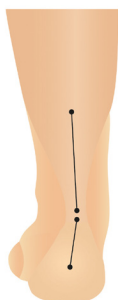
## Static STJ Neutral Foot Position

Clinicians should ensure that patients using ambulatory footwear attached to an ADM can stand with their sub-talar joint in a neutral (or close to neutral) position. Patients with a collapsing foot arch (flatfoot) may require supporting insoles in their shoes to correct this.



*The foot shown above is clearly in a state of pronation caused by a collapsing foot arch under weight bearing closed chain conditions. Orthopaedic insoles should be fitted to the footwear, so that when the patient stands the foot arch is well supported and the sub-talar joint is in a neutral position.*

Patients with neurological or muscular disorders often present with flatfoot. When standing, the foot is in pronation like the image above. But analysis of the patient walking and running shows significant dynamic supination and other clubfoot like characteristics. These patients can do well in the Ambulatory ADM providing the arch is well supported as illustrated above. Most commonly, such patients require an ADM with soft or very soft STJ springs as the feet offer little resistance to the ADM. Soft springs often achieve sufficient external rotation of the whole foot during the mid and terminal swing phases to achieve a normal looking gait. Excessively strong STJ springs can be counterproductive for this patient type.



Patients with stiff, resistant or relapsing clubfoot may present with the heel in varus when standing (as illustrated on the left). Such patients frequently have a high foot arch and do not require supporting insoles. Ideally the foot should be close to neutral before using the ADM. A foot in excessive varus may experience issues using the ADM as the lateral malleolus can become too close to, or even touch, the ADM TTJ mechanism. In such cases further correction is necessary before the ADM can be used without complications.

*Static analysis of the foot in a standing weight-bearing position is essential. Insoles may be required to support a flatfoot to achieve a near neutral STJ. Patients whose feet pronate when weight bearing often supinate during ambulation and may benefit from using an ADM.*

## Product Contents and Function



*The ADM is attached to the adapted footwear by inserting the clip until it “clicks” into position. The ADM removal from the footwear is achieved using the two tools provided*



The ADM is the only ambulatory lower leg orthosis that simultaneously acts on both key ankle foot joints to encourage the triplane foot motions required during normal ambulation.

The ADM comprises two spring powered mechanisms aligned to the patient’s Tibio-Talar Joint (TTJ) and Sub-Talar Joint (STJ). The combined motions of the ADM model and encourage a natural foot motion.

*The ADM supports the complex triplane motions of the foot to promote a natural gait*



*A foot in an ADM has a full range of motion in three geometric planes necessary to achieve a normal gait.*



## Footwear Selection

One of the advantages of the Ambulatory ADM system is that certain standard commercial off-the-shelf footwear can be adapted to attach to an ADM. It is however important to select good quality footwear that is well made and fits correctly. The foot should be held securely in the shoe, but also be free to rotate about the Tibio-Talar and Sub-Talar joints without restriction. New Balance, Reebok and many other modern leisure shoe manufacturers offer a good range. Specialist orthopaedic footwear manufacturers also have ranges in appealing designs, such as the Shein model illustrated on the next page.

## Important Size Information

The smallest footwear that can be adapted for use with an ADM is EU 18.5 (for a 10.5cm foot). This equates to an UK kids 2.5 or US kids size 3. Footwear up to EU size 34 (21cm, UK 2, US 2.5) can be used with Large ADMs.

Feet over size EU 34 up to EU 39 (25cm, UK 6, US 6.5) can be accommodated with Extra Large ADMs.

**Note:** the minimum heel width for footwear to be fitted with Extra Small (XS) to Small ADMs is 45mm. Footwear sized EU 23 (14cm, UK kids 6, US kids 6.5) or above is likely to require a Small-Medium size ADM or larger. The minimum heel width for these sizes is 57mm.



## Laces or Straps

Laces are generally preferable to straps as a more secure fit can be achieved. However, there may be cases when the user is unable to manage laces and straps have to be used. It is also difficult to find standard commercial brands in very small sizes with laces.

*The ADM enables standard commercially available footwear to be transformed into an advanced ambulatory AFO. Young users are often more receptive to bracing knowing they can wear fashionable branded footwear, such as New Balance or Reebok.*

# Footwear Selection

## Footwear Selection Key Features

The figure below illustrates the key features to look for when selecting footwear for use with an ADM.

*A high heel counter will help secure the foot and is helpful when specialist insoles are fitted*

*A high-upper and long lace cage with additional eyelets will help hold the foot securely in the shoe*



*A deep EVA foam mid-sole is essential as this is where the socket for the ADM is fitted. If required additional depth can be added during the adaption process*

*The footwear should have a single piece hard wearing rubber outsole*



*The footwear should be wide at the heel to promote stability and provide a good base for the ADM socket*

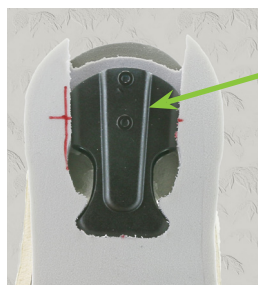
*A wide variety of footwear can be adapted to incorporate an ADM Socket, which enables ADMs to be attached. The use of good quality footwear with the characteristics shown is essential.*

# Footwear Adaption

Adaption work to enable ADMs to be attached to footwear can be undertaken by C-Pro Direct or by a suitably trained Orthopaedic workshop. Sole Kit products are available in all sizes and in White or Black EVA to assist with the adaption process.

Footwear adaption may be undertaken in one of two ways: Adaption by Machining or by Sole Replacement. The outcome in both scenarios is that the heel of the adapted footwear incorporates an ADM Socket capable of receiving ADM devices.

## Adaption by Machining



ADM Socket



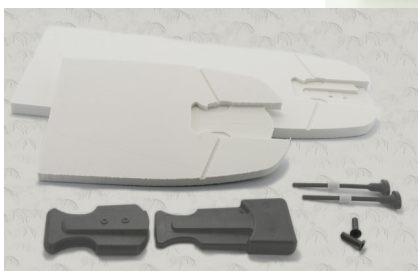
ADM Sole Plug

The rubber outsole is removed, the mid-sole is then machined using a CNC router and an ADM Socket is cemented into place.



The ADM Sole Plug is cemented over the ADM Socket. The sole is then ground flat and the rubber outsole is re-attached to the EVA mid-sole.

ADM Socket



## Sole Replacement

Sole Kits enable the fabrication of bespoke or adapted footwear to incorporate ADM Sockets. A Sole Kit comprises a machined upper and lower EVA midsole plus all the required accessories. Adaption by sole replacement can be undertaken without the use of CNC machinery.

Footwear adaption or custom footwear construction can be undertaken by C-Pro Direct or by suitably equipped orthopaedic workshops using Sole Kit products.

All enquiries contact us at [adm@c-prodirect.com](mailto:adm@c-prodirect.com)

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Distributor enquiries welcome



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