Parallel Symp (O&P): Consensus and Recommendations on the lower limb orthotic management of stroke patients

AFO - ARTICULATED VS NON-ARTICULATED

Sung-Hwa Ko, M.D. Ph.D
Department of Rehabilitation Medicine
Pusan National University Yangsan Hospital

Ankle Foot Orthosis

Parallel Symp (O&P): Consensus and Recommendations on the lower limb orthotic management of stroke patients

Ankle Foot Orthosis (AFO)

- 단하지보조기

- The most commonly prescribed orthosis for management of gait abnormalities following stroke
- Encompassing the ankle joint and the whole or part of the foot

Purpose of AFO

- Control motion
- Correct deformity
- Compensate for weakness

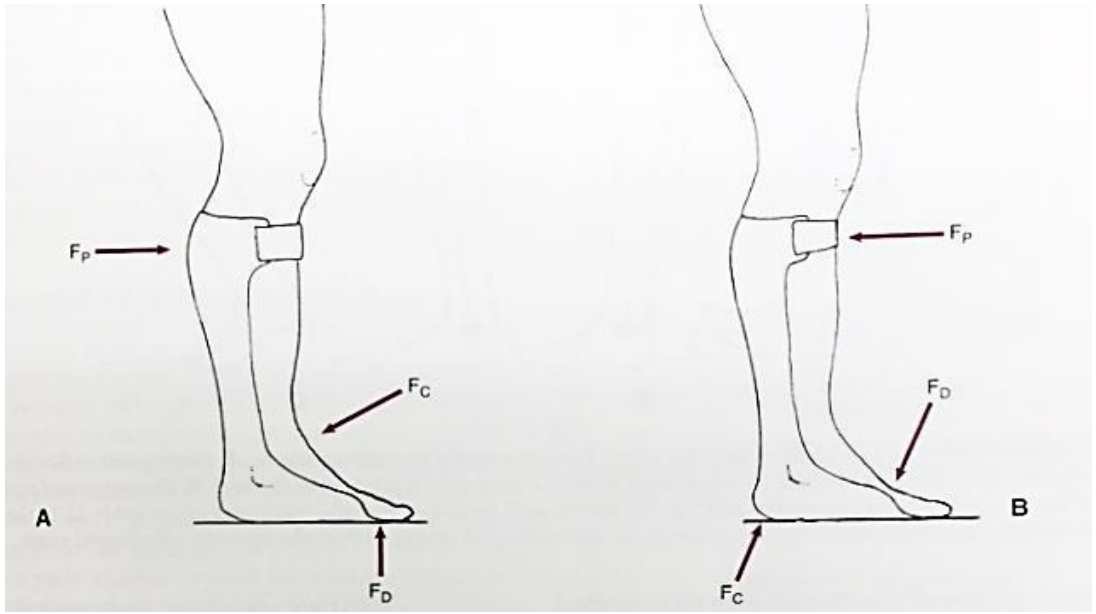
- To control the ankle-foot complex directly and to influence the knee joint indirectly

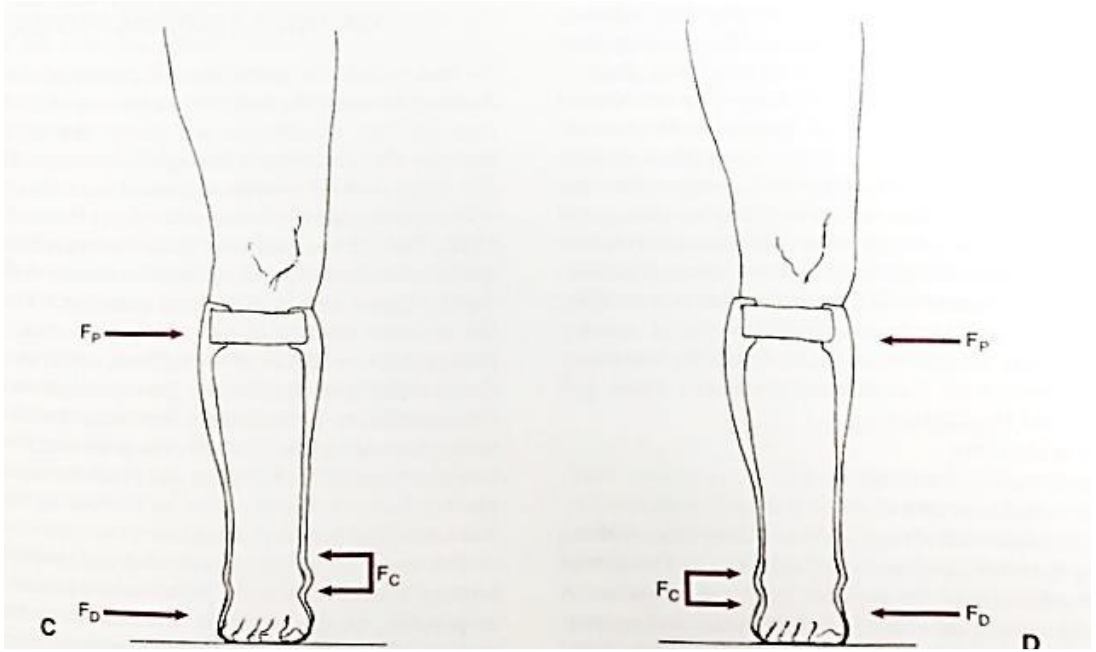
Purpose of AFO

- Non ambulatory patients
  - assist with transfer and mobility skills
  - protect deformity

- Ambulatory patients
  - assist in becoming safe walkers

The 3 or 4 force system



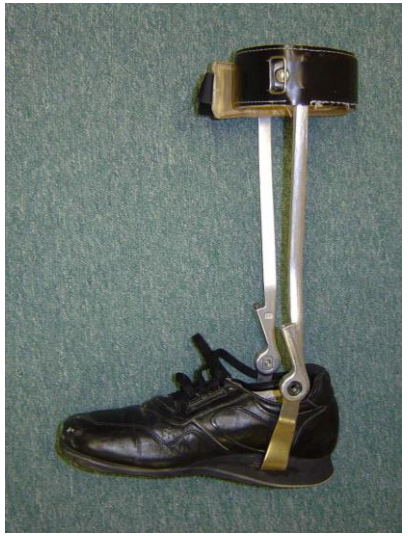


Types of Ankle Foot Orthosis

Parallel Symp (O&P): Consensus and Recommendations on the lower limb orthotic management of stroke patients

Types of AFO

- Metal AFO
  - Older style orthoses
  - Satisfied previous wearers
  - Large or heave individuals
  - Minimal contact with the leg



- Plastic AFO
  - Recent style orthoses
  - Proper distribution of the pressure using the contact area
  - Low price
  - Lightness
  - Inside the shoe

Types of plastic AFO

- Non-articulated AFOs
  - Do not incorporate joints at the ankle
  - May or may not allow motion at the ankle in the sagittal plane, depending on their flexibility

- Articulated AFOs
  - Incorporate mechanical joints at the ankle
  - To control joint range of motion (e.g., using adjustable joints)
  - To provide assistance to motion (e.g, with a dorsiflexion assist joint)
  - To limit motion (e.g., with plantarflexion or dorsiflexion stops)

Typical types of plastic AFO

Solid AFO

PLS

Hinged AFO

PTB AFO

Choo, Y.J.; Chang, M.C. Commonly Used Types and Recent Development of Ankle-Foot Orthosis: A Narrative Review. Healthcare 2021, 9, 1046.

Solid AFO (non-articulated AFO)

- Single piece of plastic
- No ankle joints

- Rigid AFO
- Anterior trim-lines
  - anterior to the malleoli
  - not flexible
- Foot drop
- Some spasticity control

Increase stability of joints with solid AFO

- Extend the trim line more anteriorly at the ankle level
- Plastic material thicker
- Place carbon inserts along the medial and lateral aspects of the ankle joint
- Corrugations within the posterior leaf of the AFO

The strength of the AFO should be matched to the patient's weight and activity level.

Plastic AFO Trim lines

Posterior leaf splint (PLS)

- 후엽스프링보조기(X)
- 판스프링보조기 (O)

- Posterior trim line, flexibility with plantar flexion
- Decreased instability
- Assist ankle dorsiflexion

Plastic AFO with 3-point inversion control

- Varus/valgus modifications
  - Creates effective 3-point system to co ntrol varus/valgus

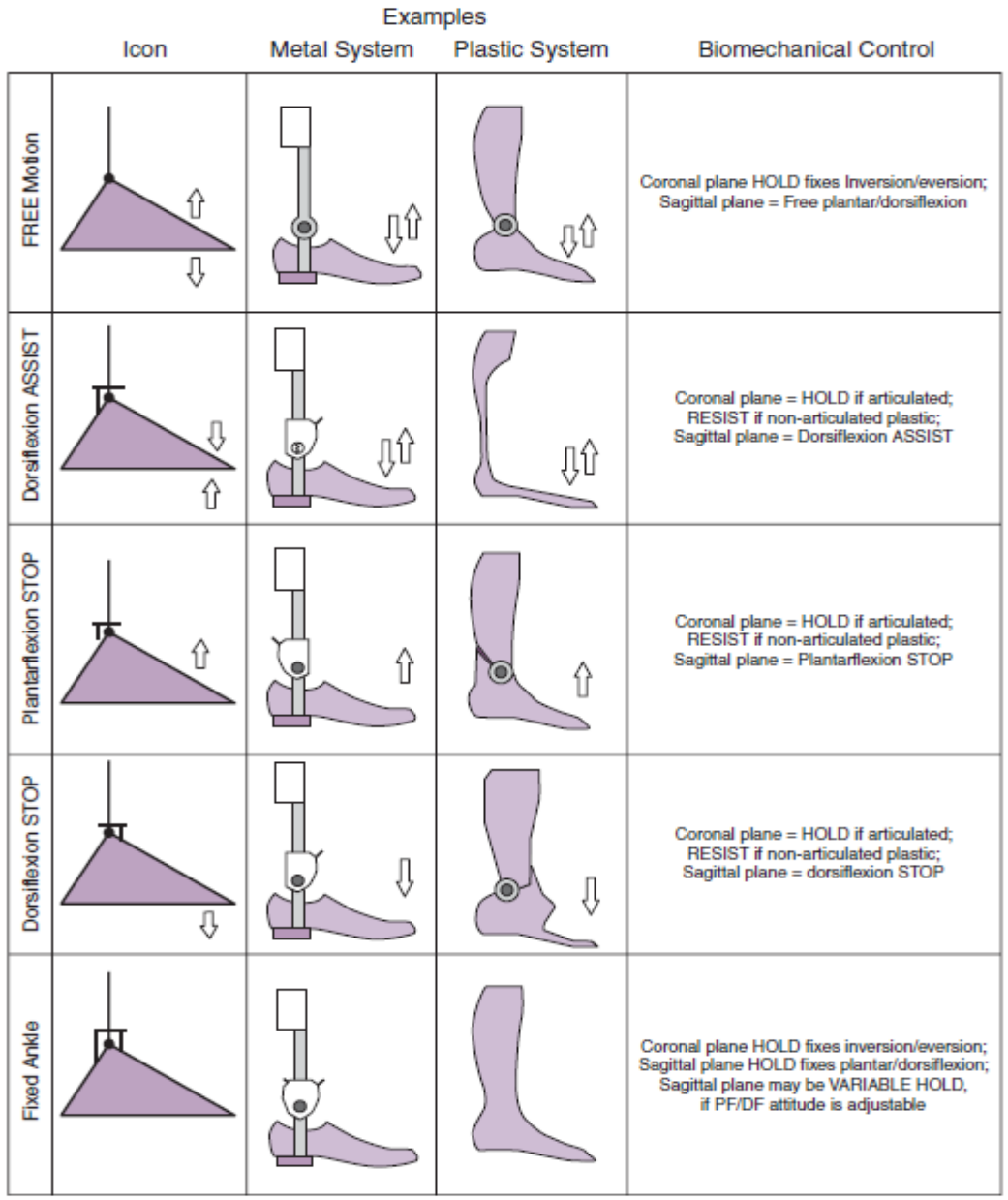
Articulated AFO

- Ankle movement is permitted but movement restrictions to a certain extent is require
- Hinges to connect two pieces, the shank and foot shells
- Commonly located on the malleolus side

- Increases ankle dorsiflexion in the terminal stance and ankle plantar flexion during the pre-swing phase
- Allows a certain degree of dorsiflexion that makes it easier for users to walk on uneven surfaces or to climb stairs.
- Helps users walk naturally.

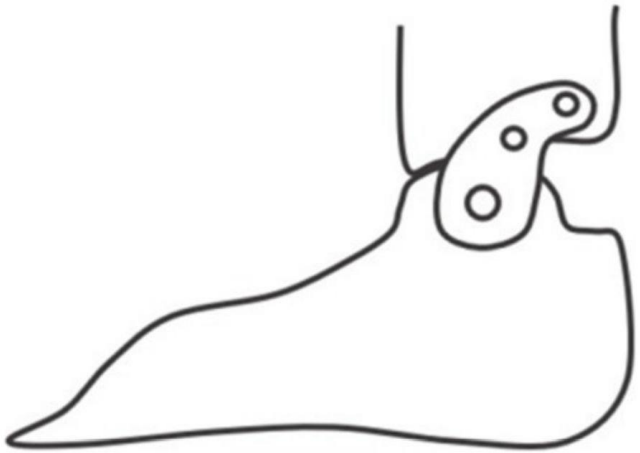
Orthotic ankle control options

- Free motion
- Dorsiflexion assist (PLS, Klenzak)
- Plantarflexion stop (=posterior stop)
- Dorsiflexion stop (=anterior stop)
- Fixed ankle

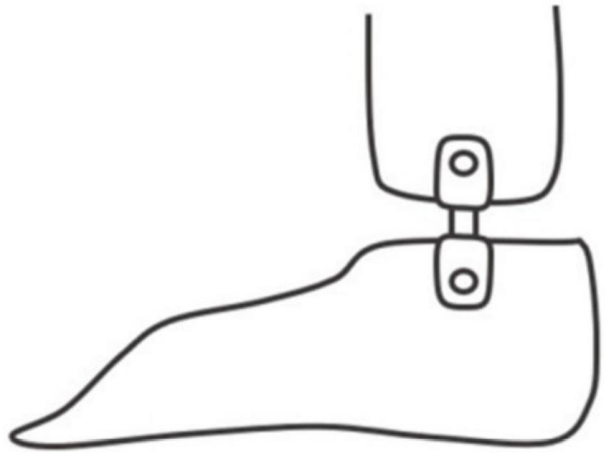


Articulated AFO

Overlap joint



Oklahoma joint



Gillette joint.

Choo, Y.J.; Chang, M.C. Commonly Used Types and Recent Development of Ankle-Foot Orthosis: A Narrative Review. Healthcare 2021, 9, 1046.

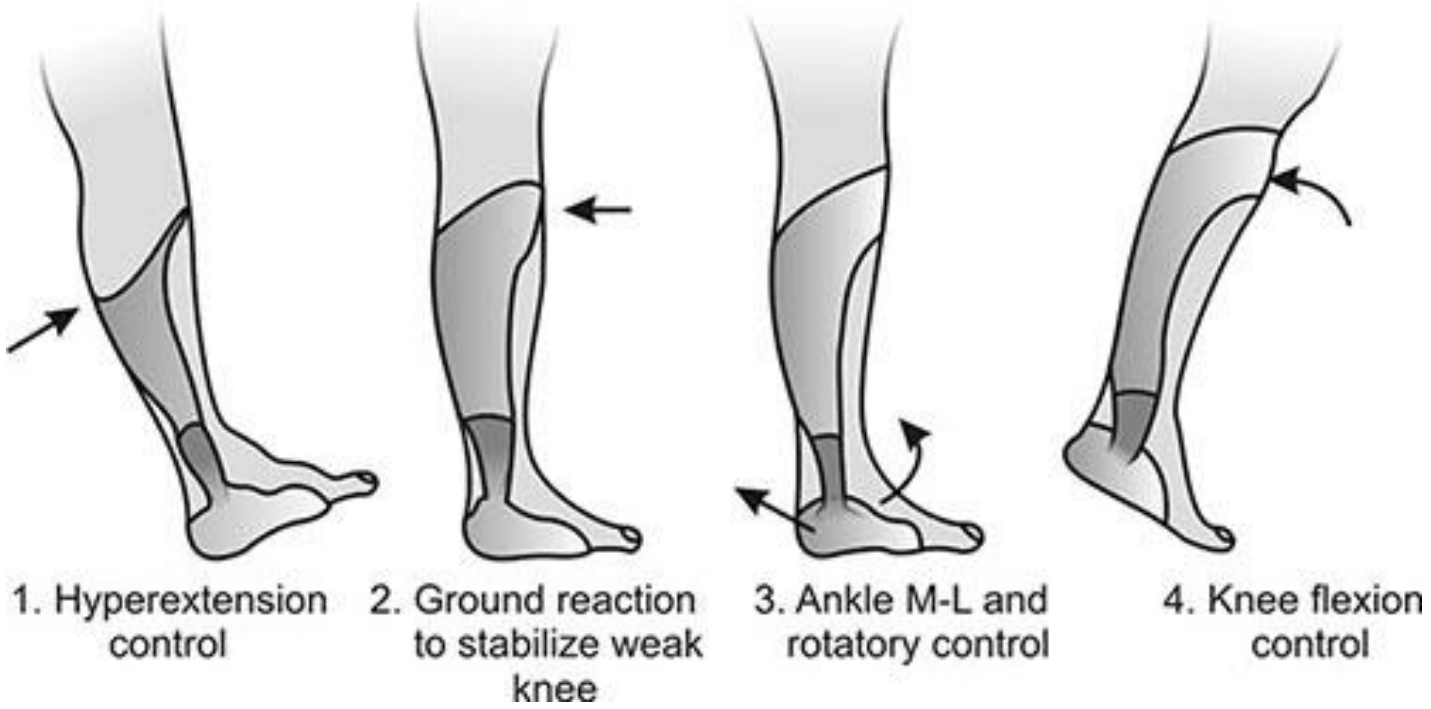
Most common Articulated AFO in Stroke

- Midline posterior stop articulated AFO
- Recommended for the plantar spasticity

FIGURE 12-14 Midline posterior stop articulated ankle-foot orthosis. Note the use of a plastic ankle joint to further decrease weight. Plastic ankle joints are more common in children (lightweight individuals). The use of a plantar stop with ankle joints is recommended for an active lightweight patient with plantar spasticity (e.g., a child with cerebral palsy).

Ground reaction AFO

- Weakness of quadriceps
- Crouch gait



Other AFOs

Patellar tendon bearing AFO (PTB AFO)

Pressure relief AFO (PRAFO)

New trend AFO_UD flex AFO

- U-shape, flexibility
- Lightness, easy to wear with one hand
- Contact area with the foot and orthosis is small
- Open heel area allows users to receive ground reaction feedback and proprioception
- Shoes size issue
- Allowed some plantarflexion

- Bae et al. (2019)
  - assist in dorsiflexion during the swing phase of walking
  - enabling effect on natural gait

New trend AFO_AF Servo AFO

- First introduced in europe in 2014
- Fabric at the front and plastic at the back, with the trimline located behind the lateral malleolus
- Produced ready-made in different sizes
- Worn immediately by operating a dial
- Easily fit their feet into shoes
- Secondary damage can also be prevented
- For patients with mild foot drop

- No studies have investigated its effectiveness

Recommendations of Ankle Foot Orthosis in Stroke Patients

Parallel Symp (O&P): Consensus and Recommendations on the lower limb orthotic management of stroke patients

Gait Pattern in Stroke

- Asymmetry
  - Longer stance phase of non paretic side
  - Longer duration of paretic left foot off (pre swing) than weight acceptance
  - Longer paretic step length
- Gait speed↓
- Cadence↓
- Stride length↓
- Foot drop
- Equinus deformity
- Stiff knee
- Knee hyperextension
- Circumduction
- Hip hiking

AHA/ASA Guideline

Guidelines for Adult Stroke Rehabilitation and Recovery

A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association

Endorsed by the American Academy of Physical Medicine and Rehabilitation and the American Society of Neurorehabilitation

- The use of an ankle-foot orthosis (AFO) can improve gait in patients with active plantarflexion during the swing phase of gait but also may be beneficial in preventing ankle contracture.

Recommendations: Adaptive Equipment, Durable Medical Devices, Orthotics, and Wheelchairs	Class	Level of Evidence
Ambulatory assistive devices (eg, cane, walker) should be used to help with gait and balance impairments, as well as mobility efficiency and safety, when needed.	I	B
AFOs should be used for ankle instability or dorsiflexor weakness.	I	B

AHA/ASA Guideline

Guidelines for Adult Stroke Rehabilitation and Recovery

A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association

Endorsed by the American Academy of Physical Medicine and Rehabilitation and the American Society of Neurorehabilitation

- With respect to the patient's perspective, it is important to determine whether an individual is willing to wear an AFO regularly.
- Considerations to improve compliance with using an AFO include verification that it fits correctly and comfortably and is acceptable in appearance.

Brain Neurorehabil. 2017 Oct;10(Suppl 1):e11
https://doi.org/10.12786/bn.2017.10.e11
pISSN 1976-8753·eISSN 2383-9910

bnr
Brain & NeuroRehabilitation

Guideline

뇌졸중 재활치료를 위한 한국형 표준 진료 지침 2016

김덕용,[1] 김연희,[2] 이종민,[3] 장원혁,[2] 김민욱,[4] 편성범,[5] 유우경,[6] 온석훈,[6] 박기덕,[7] 오병모,[8] 임성훈,[4] 정강재,[9] 류병주,[10] 임선,[4] 지성주,[11] 서한길,[8] 나은우,[12] 박주현,[4] 손민균,[11] 전민호,[13] 신희석,[14] 이성재,[15] 이양수,[16] 박시운,[17] 박윤길,[1] 백남종,[8] 이삼규,[18] 이주강,[7] 고성은,[3] 김돈규,[19] 박근영,[4] 신용일,[20] 고명환,[21] 김용욱,[1] 유승돈,[22] 김은주,[23] 오민균,[14] 장재혁,[20] 정세희,[8] 김태우,[24] 김원석,[8] 김대현,[25] 박태환,[26] 이관성,[27] 황병용,[28] 송영진[29]

권고사항

2-1-19. 단하지 보조기는 족하수가 있는 편마비 환자의 보행능력을 개선시키기 위하여 사용을 권고한다. (권고수준 B, 근거수준 1+)

Evidences of Ankle Foot Orthosis in Stroke Patients

Parallel Symp (O&P): Consensus and Recommendations on the lower limb orthotic management of stroke patients

ACRM
AMERICAN CONGRESS OF REHABILITATION MEDICINE

Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2013;94:1377-85

REVIEW ARTICLE (META-ANALYSIS)

Effects of an Ankle-Foot Orthosis on Balance and Walking After Stroke: A Systematic Review and Pooled Meta-Analysis

Sarah F. Tyson, FCSP, MSc, PhD,[a] Ruth M. Kent, BMedSci, MBBS, MD, FRCP[b,c]

From the [a]School of Health Sciences, University of Salford, Salford; [b]Academic Department of Rehabilitation Medicine, University of Leeds, Leeds; and [c]Mid Yorkshire NHS Trust, UK.

- Thirteen trials with 334 participants were selected. (until November 2011)
- The effect of an AFO on walking activity, walking impairment, and balance (weight distribution) was significant and beneficial.
- The effect on postural sway and timed mobility tests was nonsignificant, and the effect on functional balance was mixed.
- The selected trials were all crossover trials of the immediate effects; long-term effects are unexplored.

Article

CLINICAL REHABILITATION

Clinical Rehabilitation
27(10) 879–891

DOI: 10.1177/0269215513486497
cre.sagepub.com
SAGE

A systematic review and meta-analysis of the effect of an ankle-foot orthosis on gait biomechanics after stroke

SF Tyson[1,2], E Sadeghi-Demneh[2,3] and CJ Nester[2]

- Twenty trials involving 314 participants were selected. (November 2011)
- An ankle-foot orthosis can improve the ankle and knee kinematics, kinetics and energy cost of walking in stroke survivors.
- Insufficient data for pooled analysis of individual joint moments, muscle activity or spasticity

Table 3. The results of pooled-data analysis; the number of studies and participants, mean differences (including 95% confidence intervals) and effects size.

Pooled outcomes	Number of studies	Subjects	Mean difference (95% CI)	*P*-value
Kinematics (degrees)				
Ankle				
Ankle angle at initial contact (degrees)	7	106	8.58 (7.55, 9.60)	0.00001*
Peak dorsiflexion during stance phase (degrees)	7	95	2.15 (1.04–3.26)	0.0002*
Peak dorsiflexion during swing phase (degrees)	8	122	6.62 (5.43, 7.820)	0.00001*
Peak dorsiflexion at toe-off (degrees)	2	41	5.01 (3.04, 6.99)	0.000*
Knees				
Knee flexion at initial contact (degrees)	4	61	2.40 (0.20, 4.61)	0.02*
Peak knee flexion at loading response (degrees)	5	78	3.11 (0.85, 5.36)	0.007*
Peak knee extension during stance phase (degrees)	5	83	2.69 (0.64, 4.78)	0.01*
Peak knee flexion during swing phase (degrees)	6	93	0.48 (–2.18, 3.15)	0.72
Hip				
Peak hip flexion at initial contact (degrees)	2	21	0.25 (–3.49,4.10)	0.89
Peak hip extension during stance phase (degrees)	2	27	1.81 (0.83, 4.45)	0.18
Kinetics				
COP excursion under foot (% of foot length)	2	35	25.70 (20.47, 30.94)	0.0001*
Energy				
Metabolic energy cost (mL O_2/kg/m)	3	37	–0.70 (–1.18, –0.23)	0.004*
Oxygen consumption (mL O_2/kg/min)	3	37	–0.19 (–0.64, 0.27)	0.43

*Statistically significant difference.

scientific reports

OPEN

Effectiveness of an ankle–foot orthosis on walking in patients with stroke: a systematic review and meta-analysis

Yoo Jin Choo[1] & Min Cheol Chang[2,3]✉

- A total of 19 studies including 434 participants were included in the analysis
- Meta-analysis (published until june 2021) to investigate the effectiveness of ankle–foot orthosis (AFO) use in improving gait biomechanical parameters such as walking speed, mobility, and kinematics in patients with stroke with gait disturbance

Significant improvements

- Walking speed
- Cadence
- Step length
- Timed up-and-go test
- Functional ambulation
- Category (FAC) score
- Ankle sagittal plane angle at initial contact
- And knee sagittal plane angle at toe-off

No significant improvements

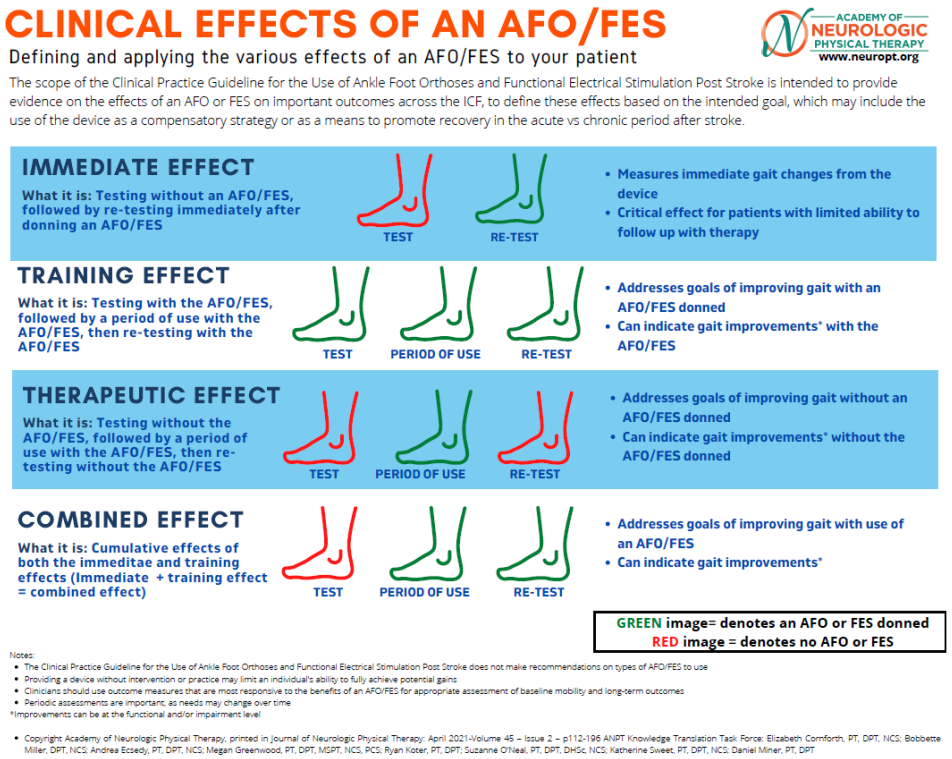
- Stride time
- Body sway
- Hip sagittal plane angle at toe-off

Choo YJ, Chang MC. Effectiveness of an ankle-foot orthosis on walking in patients with stroke: a systematic review and meta-analysis. Sci Rep. 2021 Aug 5;11(1):15879.

Clinical Practice Guideline for Use of AFO and FES Post Stroke

- Published in the April 2021 issue of Journal of Neurologic Physical Therapy

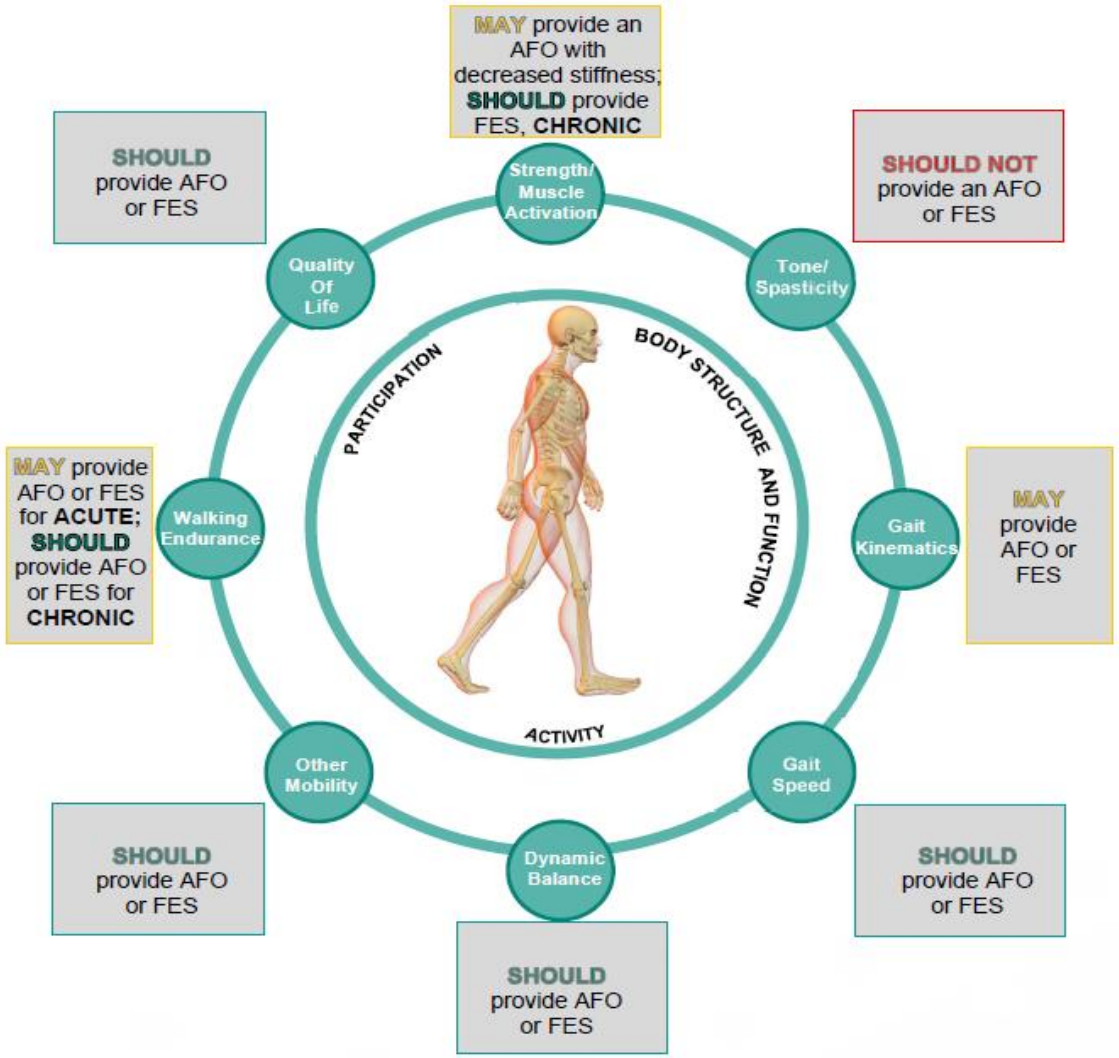
- Recommendations: Strong evidence supports the use of both AFO and FES for multiple outcomes for individuals with decreased lower extremity motor control due to both acute and chronic post stroke hemiplegia



Johnston et al. A Clinical Practice Guideline for the Use of Ankle-Foot Orthoses and Functional Electrical Stimulation Post-Stroke. *Journal of Neurologic Physical Therapy* 45.2 (2021): 112-196.

Use of Ankle Foot Orthoses and Functional Electrical Stimulation Post Stroke

ACADEMY OF NEUROLOGIC PHYSICAL THERAPY



All recommendations apply to both acute and chronic stroke unless otherwise noted.

ANPT Knowledge Translation Task Force: Elizabeth Comforth, PT, DPT, NCS; Bobbette Miller, DPT, NCS; Andrea Ecsedy, PT, DPT, NCS; Megan Greenwood, PT, DPT, MSPT, NCS, PCS; Ryan Koter, PT, DPT; Suzanne O'Neal, PT, DPT, DHSc, NCS; Katherine Sweet, PT, DPT, NCS; Daniel Miner, PT, DPT

www.neuropt.org • info@neuropt.org

Johnston et al. A Clinical Practice Guideline for the Use of Ankle-Foot Orthoses and Functional Electrical Stimulation Post-Stroke. *Journal of Neurologic Physical Therapy* 45.2 (2021): 112-196.

Clinical Practice Guideline for Use of AFO and FES Post Stroke

- Research Recommendation 3: Researchers should examine the effects of different AFO types and FES parameters.
  - As the evidence is insufficient to allow effects of specific AFO types to be differentiated, more research is needed on AFO types and stiffness, their specific benefits, potential harms, and how they impact outcomes using objective measures.
  - To increase the ability to examine these aspects, all future research studies that include AFOs should report a detailed description of the AFO type used, including the following attributes: *pre-fabricated or custom; solid, semisolid, or flexible; articulated or nonarticulated; ankle and shank angles; AFO trim lines including footplate length; and material type and stiffness*.

Johnston et al. A Clinical Practice Guideline for the Use of Ankle-Foot Orthoses and Functional Electrical Stimulation Post-Stroke. *Journal of Neurologic Physical Therapy* 45.2 (2021): 112-196.

Non-articular Vs Articular AFO in stroke

Non-articular Vs Articular AFO in stroke

- All stroke rehabilitation guidelines do not mention the types of AFO.

Contents lists available at ScienceDirect

Gait & Posture

journal homepage: www.elsevier.com/locate/gaitpost

Review

Effect of different designs of ankle-foot orthoses on gait in patients with stroke: A systematic review

Aliyeh Daryabor[a,b,c], Mokhtar Arazpour[a,b,*], Gholamreza Aminian[b]

[a] Pediatric Neurorehabilitation Research Center, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran
[b] Orthotics and Prosthetics Department, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran
[c] Student research commute, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

ARTICLE INFO

Keywords:
Orthosis
AFO
Ankle foot orthosis
Gait
Walking
Hemiplegia
Stroke

ABSTRACT

Background: Ankle foot orthoses (AFOs) are used to improve the gait of patients with stroke.
Research question: The current review aimed at evaluating the efficacy of different designs of AFOs and comparison between them on the gait parameters of individuals with hemiplegic stroke.
Methods: The search strategy was based on the population intervention comparison outcome (PICO) method. A search was performed in PubMed, ISI Web of Knowledge, Scopus, Science Direct, and Google Scholar databases.
Results: A total of 27 articles were found for the final evaluation. All types of AFOs had positive effects on ankle kinematic in the first rocker and swing phases, but not on knee kinematics in the swing phase, hip kinematics or the third rocker function. All trials, except two, assessed immediate or short-term effects only. The articulated passive AFO compared with the non-articulated passive AFO had better effects on some aspects of the gait of patients with hemiplegia following stroke, more investigations are needed in this regard though.
Significance: An ankle-foot orthosis can immediately improve the dropped foot in the stance and swing phases. The effects of long-term usage and comparison among the different types of AFOs need to be evaluated.

Effect of different designs of AFOs on gait in patients with stroke: A systematic review (2018)

The current review addressed the following questions:

1. Effect of the nonarticulated AFOs on the gait function of patients with stroke
2. Effect of articulated AFOs on the gait functions of patients with stroke
3. Comparison between articulated and non-articulated AFOs on the gait function of patients with stroke (4 studies compared non-articulated and articulated AFOs)
   - C. Bleyenheuft et al., Assessment of the Chignon® dynamic ankle-foot orthosis using instrumented gait analysis in hemiparetic adults. Annales de réadaptation et de médecine physique, Elsevier, 2008.
   - M.-P. De Sèze et al., Effect of early compensation of distal motor deficiency by the Chignon anklefoot orthosis on gait in hemiplegic patients: a randomized pilot study, Clin. Rehabil. 25 (11) (2011) 989–998.
   - H. Gök et al., Effects of ankle-foot orthoses on hemiparetic gait, Clin. Rehabil. 17 (2) (2003) 137–139.
   - S.J. Mulroy et al., Effect of AFO design on walking after stroke: impact of ankle plantar flexion contracture, Prosthet. Orthot. Int. 34 (3) (2010) 277–292.

Table 3
Characteristics of the Studies on the Comparison Between Non-articulated and Articulated AFOs on Kinematics, Kinetics, and EMG Parameters.

Author / Year	Samples	Without AFO condition (barefoot or shoe)	AFO Type	Outcome Measures	Main Outcomes
Gök et al. [18]	12 patients with subacute/chronic stroke, able to walk independently while using a walking aid, mean time from stroke: 67 d, mean age =54 y MAS: 2–3	barefoot	– Plastic AFO (rigid) – Metal AFO-PS	Ankle kinematics Kinetic: knee moment	The 2 types of orthoses had similar positive effects on ankle DF angle at HS (barefoot: –16.18, plastic AFO: –6.48, metal AFO: –0.37) and swing (barefoot: –12.38, plastic AFO: –1.29, metal AFO: 3.44). The metal AFO was better at increasing the ankle DF angle and at decreasing the int. knee flexion moment (barefoot: 0.36 N/m, plastic AFO: 0.32 N/m, metal AFO: 0.20 N/m) than the plastic AFO.
Bleyenheuft [24]	10 patients with chronic stroke, able to walk without assistance, mean age = 49 y, time from stroke = 28 mo MAS: 1.5	shoe	– Chignon AFO – PLS AFO	Ankle and knee kinematics	The ankle's kinematics were better with the Chignon orthosis than no orthosis, notably in terms of ankle angle at HS (-0.8° versus −7.9°; P = 0.009) and ankle DF at mid-swing (1.7° versus −5.5°; P = 0.006). There were no statistically significant changes in knee kinematic variables (P > 0.05).
de Sèze [13]	28patients with subacute stroke and PF spasticity, able to walk > 10 m Chignon group= 13 subjects, mean age=56.4 y, mean time from stroke:104.4 d control group= 15 subjects, mean age=53 y, mean time from stroke: 56 d MAS ≥3	ns	– Chignon AFO (n = 13) – PLS AFO: control group (n = 15)	Ankle and knee kinematics	In the chignon group versus the control group, dropped foot and knee recurvatum were better corrected at the days 0 (P < 0.05), 30 (P < 0.05) and 90 (P < 0.05).
Mulroy [21]	30 patients with chronic stroke with (n=21) and without (n=9) a moderate ankle PF contracture, able to walk without assistance, mean age = 58.3 y, mean time from stroke = 25.3 mo MAS: 1.5	their own shoes	– RAFO – Plastic AFO-PS – Plastic DA-DS AFO	Ankle and knee kinematics Ankle and knee kinetics EMG	All AFOs in both groups increased ankle DF in IC and swing, knee flexion in IC and ext. PF moment in IC. TA EMG decreased only in the AFO-PS than the shoe only (8.2 vs. 15.8). Soleus EMG (48 vs. 32) and peak ankle DF (0.59 vs. 0.43) in stance were the greatest in the AFO-PS compared with shoe only. Peak ankle DS in stance and DF moment in terminal stance were greater with the AFO-PS than the RAFO for both groups. For the contracture group, the RAFO lowered the peak knee extension moment in stance than the AFO-PS (-0.11 Nm/kgm vs. −0.24 Nm/kgm). In addition, both the AFO-PS and RAFO increased knee flexion in LR than the DA-DS AFO (20.3, 19.4 and 17.4, respectively for the neutral group: 13.5, 14.9 and 11.7, respectively for the contracture group).

Y: year, mo: month, MAS: Modified Ashworth Scale, int.: internal, ext.: external, GRF: ground reaction force, DF: dorsiflexion, PF: plantar flexion, DA-DS AFO: dorsi-assist/dorsi-stop stop AFO, HS: heel strike; d: day, ns: non-stated.

Studies compared non-articulated and articulated AFOs

- Bleyenheuft et al. compared the Chignon AFO with a PLS AFO and found significant differences in the ankle dorsiflexion angle in initial contact and mid-stance, but no changes in knee angle.

- De Sèse et al. compared the Chignon and standard polypropylene AFOs and found better correction of drop foot, foot varus, and knee recurvatum in the Chignon group than in the control group on the days 0, 30, and 90 of usage.

Lateral view of Chignon AFO

Studies compared non-articulated and articulated AFOs

- In the study by Gök et al., the metallic AFO was better at increasing the ankle dorsiflexion angle than the plastic AFO. Metallic AFOs provided better stabilization of the ankle, allowing improved heel strike and push-off.

- In another study, Mulroy et al. demonstrated an increase in peak ankle dorsiflexion of stance phase in AFO-PS, compared with that of the rigid AFO, but it was not statistically significant. Also, there was significant increase in the external ankle plantarflexion moment in loading response and decrease in the external ankle dorsiflexion moment in terminal stance with AFO-PS than the RAFO. Individuals without a contracture benefit from an AFO that permits dorsiflexion mobility in stance and those with quadriceps weakness may more easily tolerate an AFO with plantar flexion mobility in loading.

Studies compared non-articulated and articulated AFOs

- Conclusion of the SR
  - The articulated passive AFO compared with the non-articulated passive AFO had better effects on some aspects of the gait of patients with hemiplegia following stroke, more investigations are needed in this regard though.

- However, Most subjects of studies were ambulatory without the assistance.

International Society for Prosthetics and Orthotics

REPORT OF A CONSENSUS CONFERENCE ON THE ORTHOTIC MANAGEMENT OF STROKE PATIENTS

Edited by
Elizabeth Condie

Associate editors
James Campbell
Juan Martina

Held at:
Avegoor Conference Centre
Ellecom
The Netherlands
21st - 26th September, 2003

CONCLUSIONS AND RECOMMENDATIONS ARISING FROM SYNDICATE AND GENERAL DISCUSSION SESSIONS

In view of the volume of the material covered by the reviewers, this section primarily lists the conclusions and recommendations agreed by conference during the syndicate and discussions sessions. A comprehensive list of detailed recommendations, duly graded, may be found in the key review papers themselves.

The undernoted recommendations (16-20) resulted from the Syndicate A and General Discussions of Review Papers R1 (Establishing a scientific basis for orthotic management), R2 (AFO and FO, non-articulated) and R3 (AFO, articulated).

		Grade of Recommendation
16.	Indications for a *non-articulated AFO* were **agreed** as follows:	
	• Poor balance, instability in stance	*
	• Inability to transfer weight onto affected leg in stance	C
	• Moderate to severe foot abnormality; equinus, valgus or varus, or a combination	C
	• Moderate to severe hypertonicity	*
	• As above, but with mild recurvatum or instability of the knee	C
	• To improve walking speed and cadence	C
17.	Indications for an *articulated AFO* were **agreed** as follows:	
	• Dorsiflexor weakness only	*
	• Where passive or active range of dorsiflexion is present	*
	• Where dorsiflexion is needed for sit-to-stand or stair climbing	*
	• To control knee flexion instability only, articulated AFO with dorsiflexion stop	*
	• To control recurvatum only, articulated AFO with plantar flexion stop	*
	• To improve walking speed and cadence	B
18.	Conference **agreed** that a custom-made *Posterior Leaf Spring* (PLS) ankle foot orthosis falls neither into the "articulated" nor "non-articulated" AFO category, and for the purposes of this report is therefore referred to as a *flexible* AFO. Indications for its use were agreed as follows:	
	• Isolated dorsiflexor weakness	*
	• No significant problem with tone	*
	• No significant medio-lateral instability	*
	• No need for orthotic influence on the knee or hip.	*
19	Conference considered the use of prefabricated, "off-the-shelf" AFO's and **recommended** that their use should be limited to the following situations only:	
	• As a temporary, evaluation orthosis.	*
	• where there is a need for early mobilisation before a custom orthosis can be provided	*
	N.B. Conference does **not recommend** *an off-the-shelf orthosis in the presence of problematic increased tone in plantar or dorsiflexor muscles, or in the presence of significant medio-lateral instability.*	*
20.	Conference considered the question of providing an AFO for use in weight bearing as soon as the patient is medically stable. There is no evidence in the literature in support of this practice however conference **agreed** that the following benefits can be extrapolated from the literature on the orthotic management of cerebral palsy:	
	- Encourages balanced standing	*
	- Provides ankle stability	*
	- Promotes postural alignment	*
	- Maintains range of motion at the ankle	*
	- Supports early mobilisation	*

Report of a Consensus Conference on the Orthotic Management of Stroke Patients_ISPO 2003

- Indications for **nonarticulated AFO**
  - Poor balance, instability in stance
  - Inability to transfer weight onto affected leg in stance (C)
  - Moderate-to-severe foot abnormality; equinus valgus or varus, or combination (C)
  - Moderate-to-severe hypertonicity
  - As above, but with mild recurvatum or instability of the knee (C)
  - To improve walking speed and cadence (C)

ISPO
INTERNATIONAL SOCIETY FOR PROSTHETICS AND ORTHOTICS

Report of a Consensus Conference on the Orthotic Management of Stroke Patients_ISPO 2003

- Indications for **articulated AFO**
  - Dorsiflexor weakness only
  - In presence of passive or active range of dorsiflexion
  - To control knee flexion instability only, articulated AFO with dorsiflexion stop
  - To control recurvatum only, articulated AFO with plantarflexion stop
  - To improve walking speed and cadence (B)

ISPO
INTERNATIONAL SOCIETY FOR PROSTHETICS AND ORTHOTICS

Report of a Consensus Conference on the Orthotic Management of Stroke Patients_ISPO 2003

- Indications for **posterior leaf spring AFO**
  - Isolated dorsiflexor weakness
  - No significant problem with tone
  - No significant mediolateral instability
  - No need for orthotic influence on the knee or hip

ISPO
INTERNATIONAL SOCIETY FOR PROSTHETICS AND ORTHOTICS

Report of a Consensus Conference on the Orthotic Management of Stroke Patients_ISPO 2003

- Benefits of providing an AFO for use in weight bearing as soon as the patient is medically stable
  - Encourages balanced standing
  - Provides ankle stability
  - Promotes postural alignment
  - Maintains range of motion at the ankle
  - Supports early mobilization

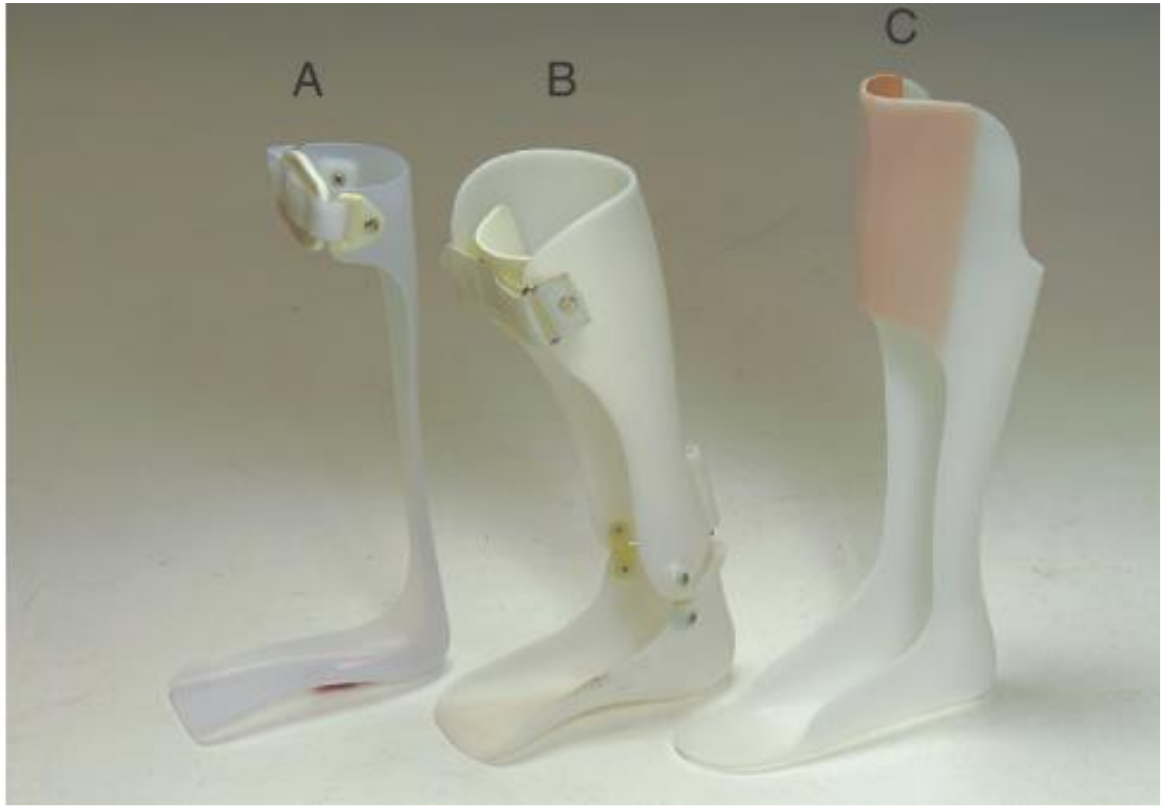
ISPO
INTERNATIONAL SOCIETY FOR PROSTHETICS AND ORTHOTICS

Report of a Consensus Conference on the Orthotic Management of Stroke Patients_ISPO 2003

- Recommendations applicable to all lower limb orthoses
  - Alignment of orthosis at terminal stance/preswing is critical and influences step length, gait symmetry, speed, and energy consumption
  - Contracture at any lower limb joint may limit the effectiveness of an orthosis

ISPO
INTERNATIONAL SOCIETY FOR PROSTHETICS AND ORTHOTICS

Common AFO prescriptions



A. Foot drop

B. Plantar spasticity

C. Lumbar spinal cord injury

Common AFO Prescriptions in stroke

- Isolated weakness of ankle DF without spasticity
  - Posterior leaf spring (PLS)

- Equinus with spasticity
  - Rigid plastic AFO with thick, anterior trim line of ankle joint
  - Articulated AFO with mechanical ankle joint of PF stop at 90

Common AFO Prescriptions in stroke

- Excessive DF with knee instability during stance phase (weak ankle PF)
  - AFO with DF stop
  - GRAFO
  - rigid plastic AFO with anterior trim line

- Weak knee extensor
  - GRAFO

THANK YOU FOR YOUR ATTENTION

Pusan National University
Yangsan Hospital