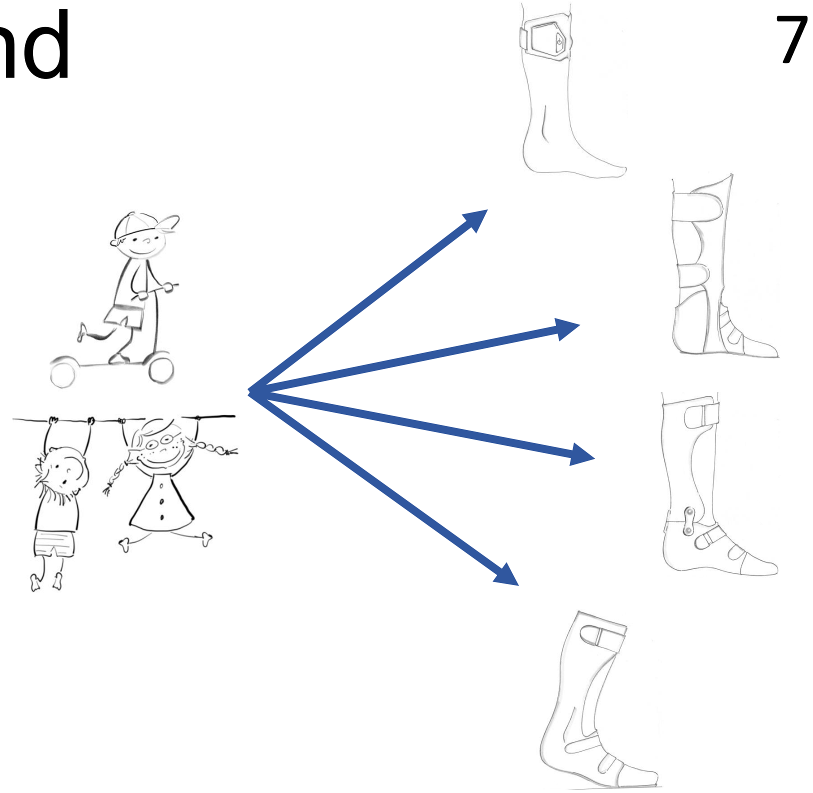
AFO provision for ambulatory children with Cerebral Palsy in Norway

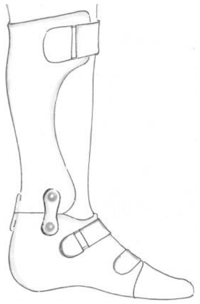
Current practice, evidence and national guideline

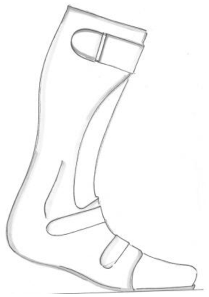
7.Oktober 2025



Tobias Goihl, CPO, PhD
Trøndelag Ortopedisk Verksted, TOV, Trondheim, Norway
Department of Neuromedicine and Movement Science, NTNU, Trondheim, Norway

Ankle-foot orthoses (AFOs) most common orthosis for children with Cerebral Palsy (CP)





Address impairments of body structure and function:

compensate for weak muscle activity
prevent or limit progression of deformities
preserve muscle length

reduce gait deviations
reduce energy cost of walking
increase gait speed and step length

NORCP årsrapporter

Conner 2022

Ricardo 2021

Wingstrand 2014

Use of AFOs varies by

- **Country:** 35% (Denmark) to 57% (Scotland)

8.928 children from:

- Sweden
- Norway
- Finland
- Iceland
- Scotland
- Denmark

Adapted from:

Stockman 2023

NORCP årsrapporter

Use of AFOs varies by

- **Country:** 35% (Denmark) to 57% (Scotland)
- **Region:** 34% to 76% in different regions in Norway

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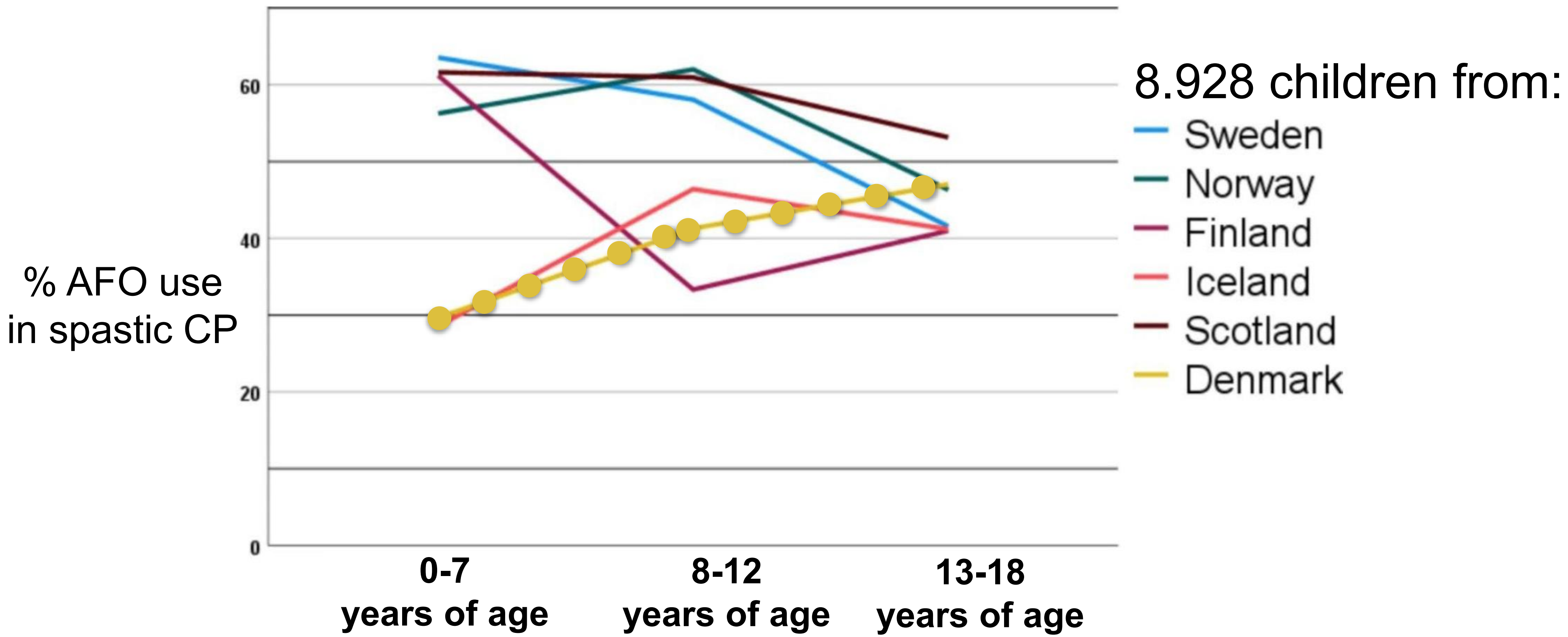
NORCP årsrapporter

TOV NTNU

Use of AFOs varies by

- **Country:** 35% (Denmark) to 57% (Scotland) use AFOs
- **Region:** 34% to 76% in different regions in Norway use AFO
- **Age** at which AFOs are introduced



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TOV NTNU

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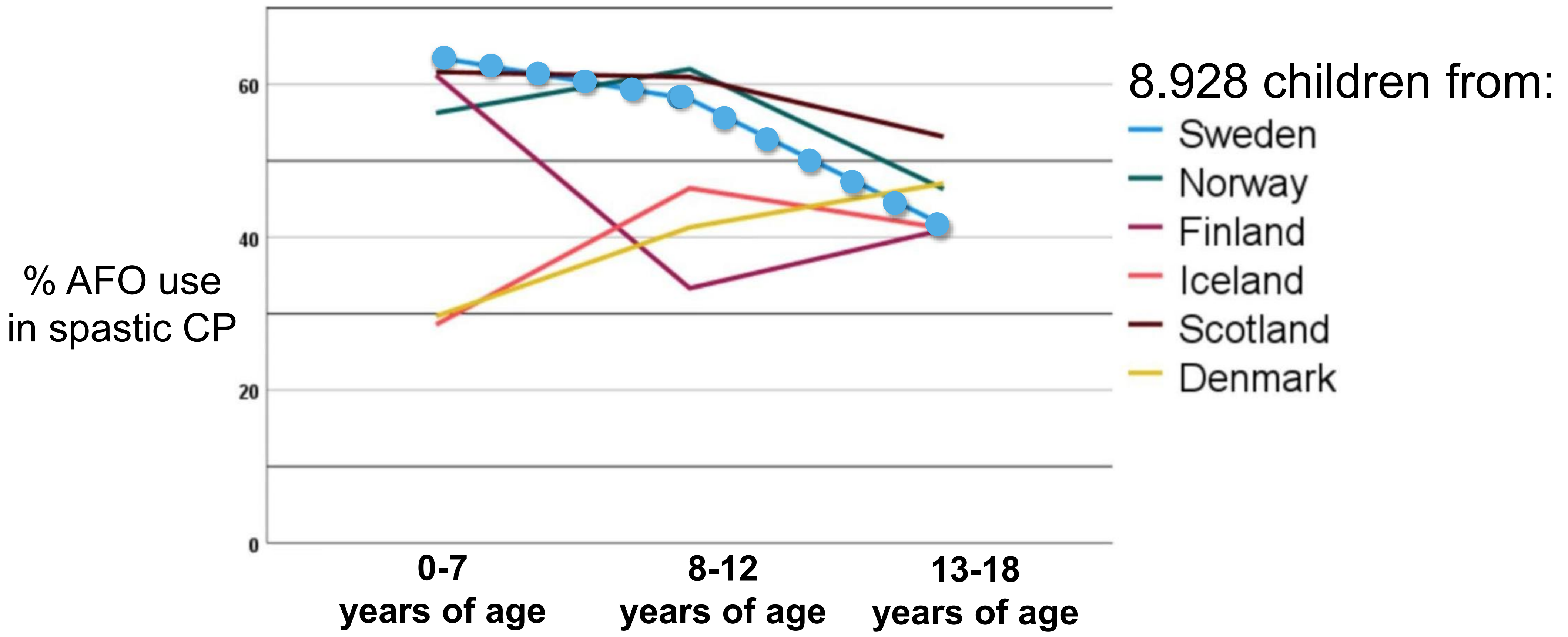

Adapted from:

Stockman 2023

NORCP årsrapporter

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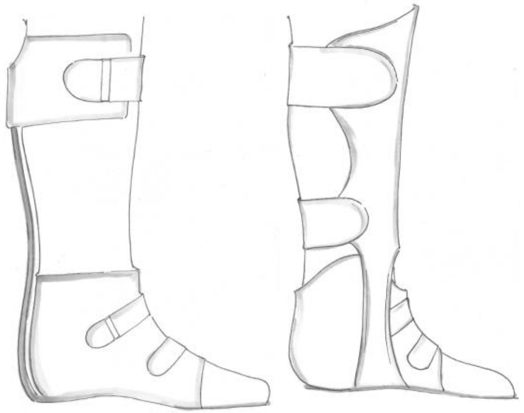
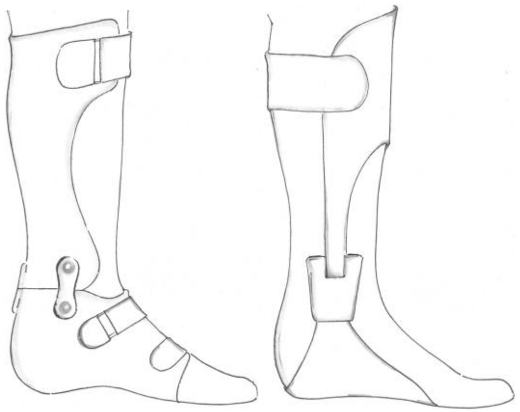
Variation of AFO designs:

Variation of AFO designs:

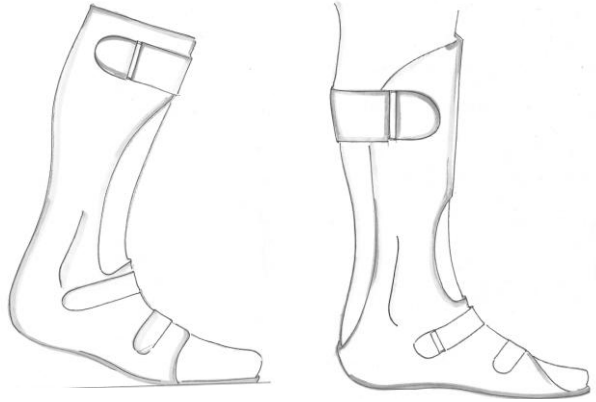
Flexible



Articulated



Rigid



AFO provision practice in Norway

Patient assessment	Fabrication & Fitting	Delivery and Evaluation

RATE

Original Manuscript

Journal of Rehabilitation and Assistive Technologies Engineering
Volume 11: 1–11

DOI: 10.1177/20556683241276804
journals.sagepub.com/home/jrt
Sage

Provision of ankle foot orthoses for children with cerebral palsy in Norway

Tobias Goihl[1,2], David F. Rusaw[3], Karin Roeleveld[1] and Siri Merete Brændvik[1,4]

RATE_Goihl

TOV NTNU

Survey among all Norwegian orthotists who work with children with CP

54% participation

Survey among all Norwegian orthotists who work with children with CP

54% participation

Visual or instrumented assessment

Gait Assessment:

(74%) (26%)

AFO evaluation:

(49%) (51%)

Survey among all Norwegian orthotists who work with children with CP

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Gait Assessment:

(74%) (26%)

AFO evaluation:

(49%) (51%)

Use of Shank Vertical Angle to Control AFO alignment:

(79%) (21%)

TOV NTNU

Survey among all Norwegian orthotists who work with children with CP

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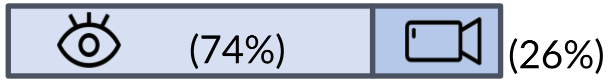
Visual or instrumented assessment

Gait Assessment:



AFO evaluation:

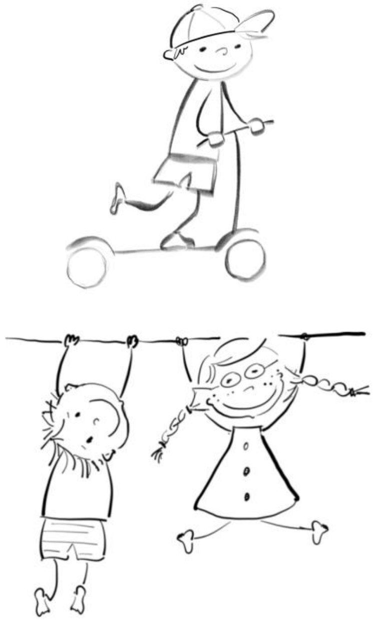
Use of Shank Vertical Angle to Control AFO alignment:

Patient age and preference affect AFO design

- AFO must not limit transition and play
- Appearance and function become more important with age
- AFO must function in daily life

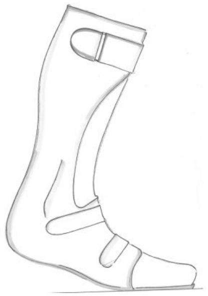
Survey among all Norwegian orthotists who work with children with CP | 54% participation

Which child should receive which AFO?



Flexible/articulated design

varying degree of ankle movement

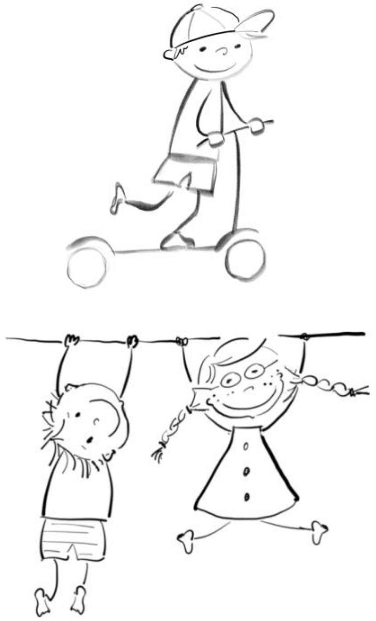


Rigid AFO

no ankle movement

Survey among all Norwegian orthotists who work with children with CP | 54% participation

Which child should receive which AFO?



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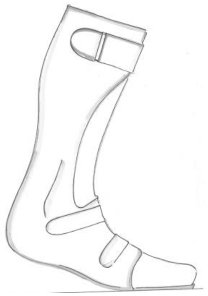

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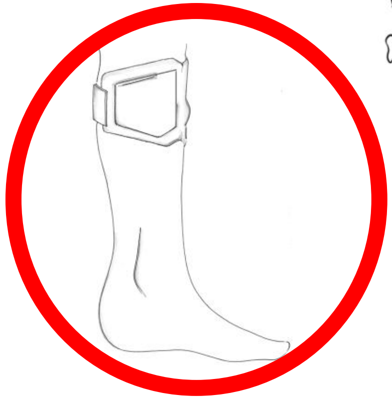
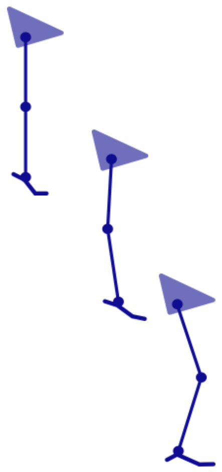
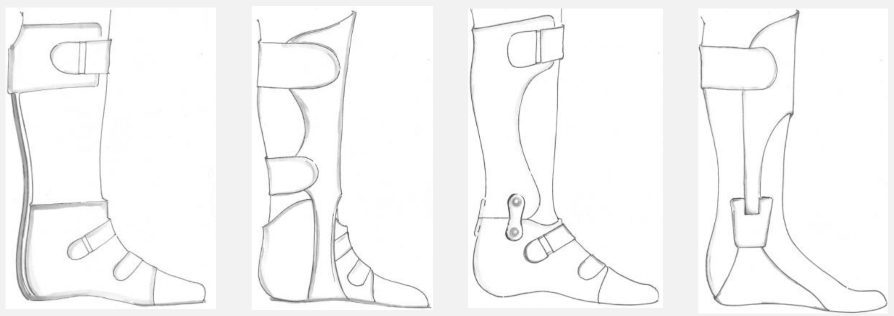
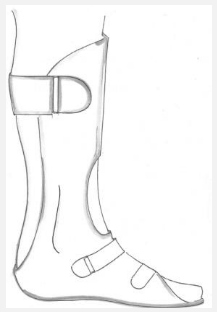
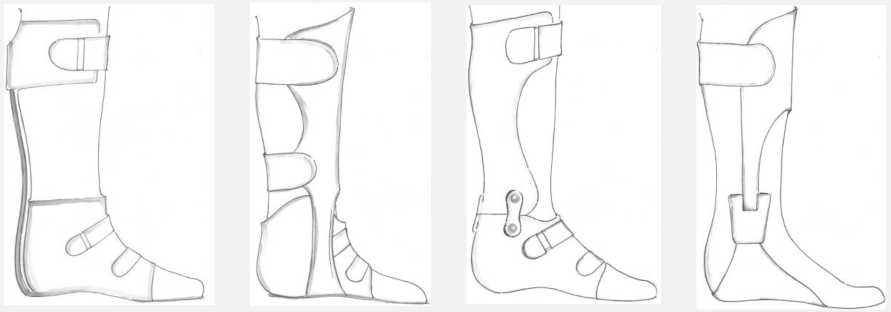
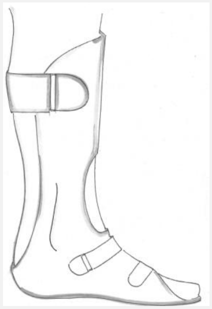


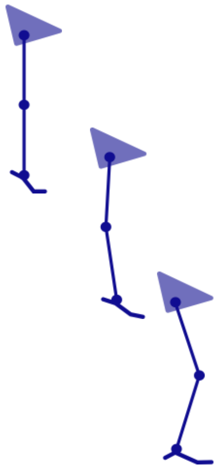
Functional
Electrical
Stimulation



Gait Pattern	flexible/articulated AFO 	rigid AFO 
Equinus (short gastrocnemius)		
Recurvatum (↓tibia progression)		
Crouch		







Gait Pattern	flexible/articulated AFO	rigid AFO
Equinus (short gastrocnemius)		
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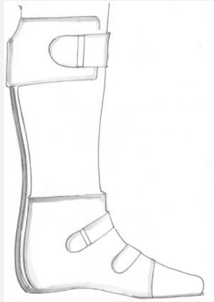
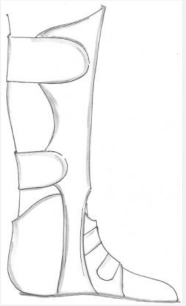
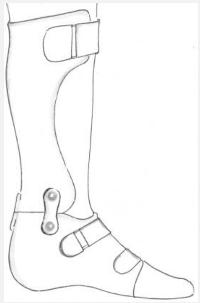
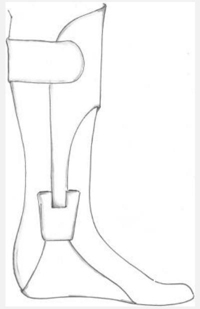
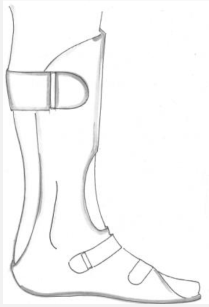
Crouch		

Owen 2010

ISPO 2008

Wright 2019

Gait Pattern	flexible/articulated AFO    	rigid AFO  *42% report low compliance*
		approved by
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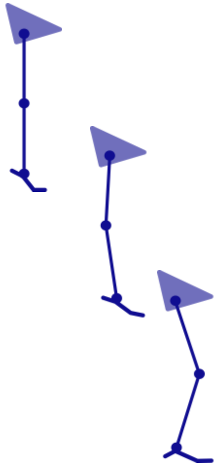
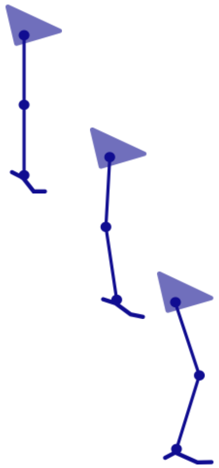
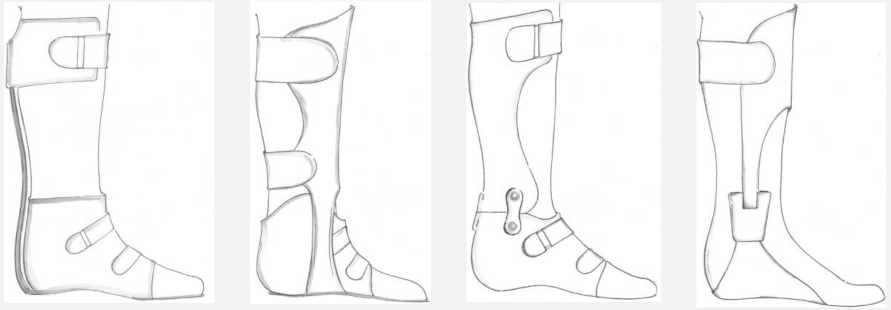
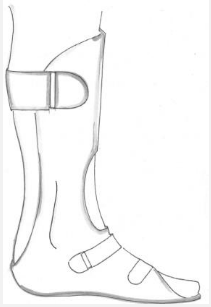


Owen 2010

ISPO 2008

Wright 2019



Gait Pattern	flexible/articulated AFO  *preferred by other clinicians & patients* approved by	rigid AFO  *42% report low compliance* approved by
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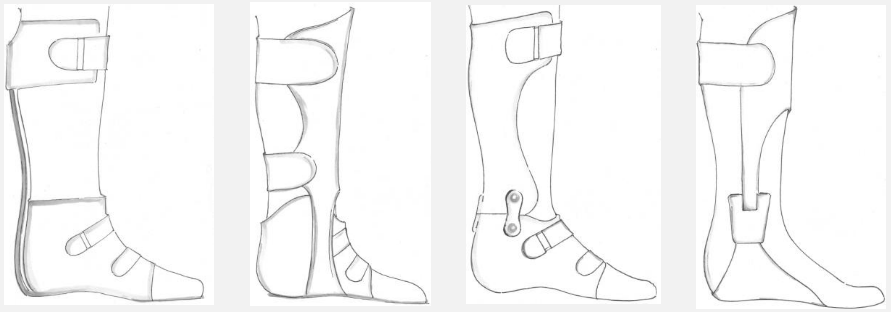
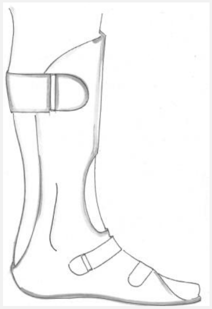
Gait Pattern	flexible/articulated AFO	rigid AFO
		
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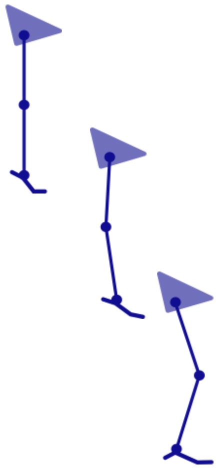


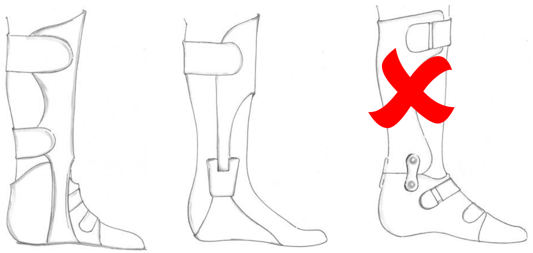
Owen 2010

ISPO 2008

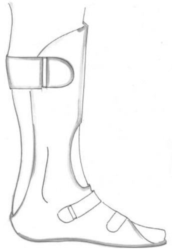
Wright 2019

*Crouch

AFOs with limited dorsiflexion



or



TOV NTNU

Literature reviews

- potential benefits of various AFO-designs
- few recommendations on choice
- Little information on foot deformities

Aboutorabi 2017
Firouzeh 2021
Faccioli 2025
Conner 2022

TOV NTNU

Literature reviews

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Aboutorabi 2017

Firouzeh 2021

Faccioli 2025

Conner 2022

N.I.C.E. from the UK

- Equinus: consider rigid or articulated AFO
- Crouch: consider rigid AFO

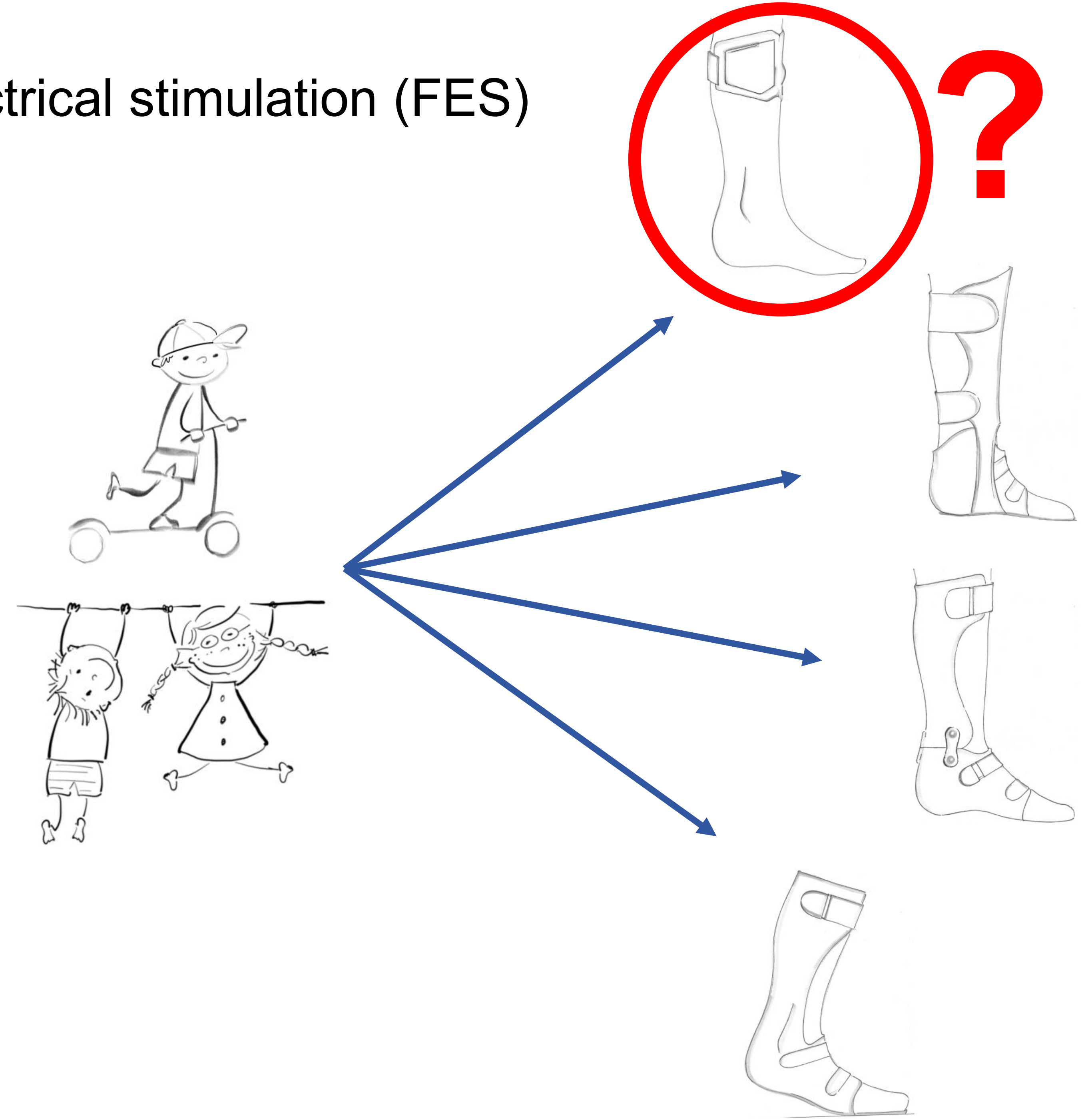
NICE 2016

Guidelines from France

- Equinus: “AFO” up to age 12
- Crouch & other gait patterns: not included

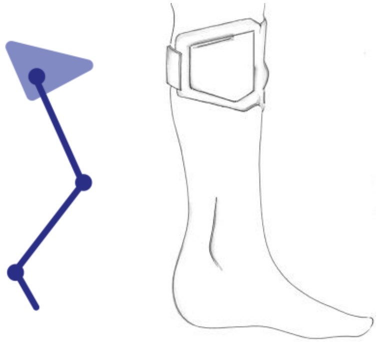
Demont 2022

Functional Electrical stimulation (FES)



Mooney 2019

Segal 2023

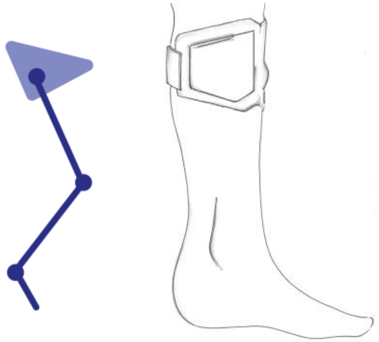


Functional Electrical stimulation (FES) for children with CP & Dropfoot

91% of respondents approve FES

Mooney 2019

Segal 2023



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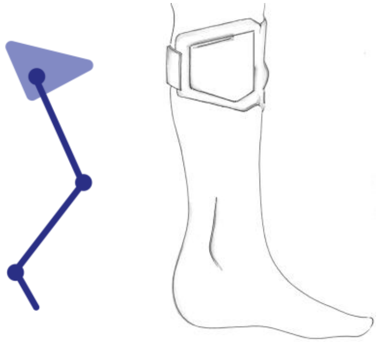
91% of respondents approve FES

Are you confident using FES?		
Yes	20	47 %
No	23	53 %



Functional Electrical stimulation (FES) for children with CP & Dropfoot

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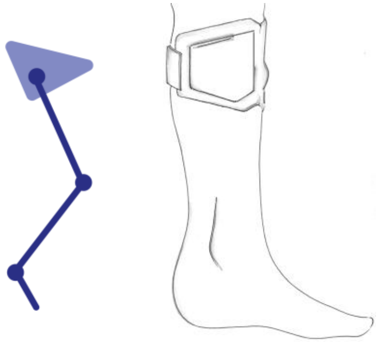
Do you use FES for ambulatory children with CP	
Yes	16
No	4



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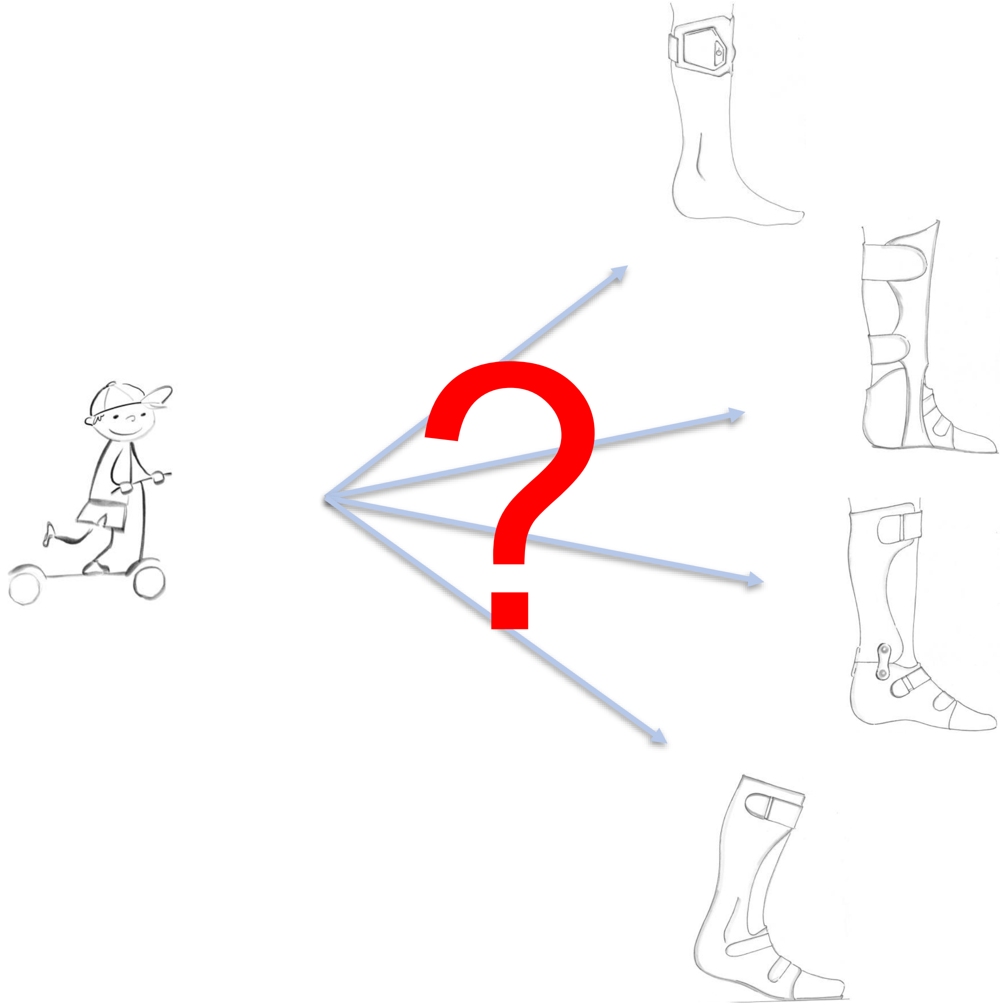
Yes	16
No	4

FES in children with **contracture** of plantarflexors	
Yes	3
No	13

FES in children with **spasticity** of plantarflexors	
Yes	10
No	6



We need **strong** recommendations

based on **low quality evidence**

with sufficient detail to **be clinically useful**

NorCP
Kunnskapsbasert retningslinje

Norwegian quality and follow up program for cerebral palsy

Evidence-based guideline for the follow-up of individuals with cerebral palsy

NorCP
Kunnskapsbasert retningslinje

metodebok.no

Cerebral parese (NorCP) → Ortoser

Medical comorbidities

Muscle tone

Orthoses

Orthopedics

Motor skills

Coping and mental health

Eating, drinking, swallowing and nutrition

Cognition

Communication

Transition to adult life

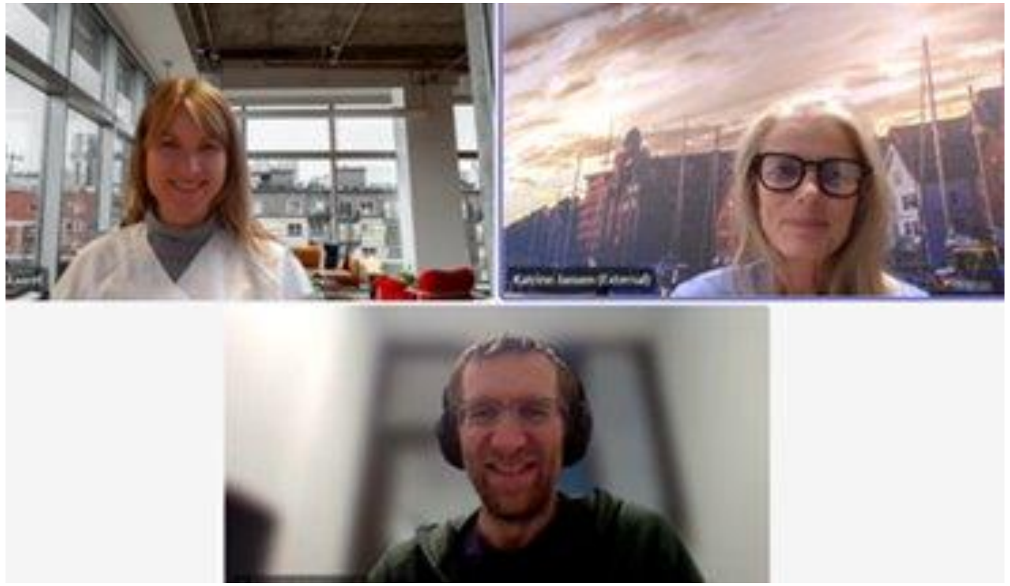
Alternative treatment methods

Palliative care

TOV NTNU

Working group: Orthoses

Ingrid Skaaret, CPO (PhD)
Ass. Prof. OsloMet
Gaitlab Rikshospitalet
Sophies Minde Ortopedi
Oslo



Katrine Jansen, CPO (BSc)
Drevelin Ortopedi
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Bergen

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Trøndelag ortopedisk verksted
NTNU
Trondheim

NorCP
Kunnskapsbasert retningslinje

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Cerebral parese (NorCP) → Ortoser

INTRODUCTION

Ankle-foot orthoses(AFO)

Arm-/hand orthoses

Dynamic textile orthoses (DTO)

Functional electrical stimulation (FES)

Spinal Orthoses

TOV NTNU

NorCP
Kunnskapsbasert retningslinje

metodebok.no

Cerebral parese (NorCP) → Ortoser → Ankel-fotortose (AFO)

Introduction

Main Recommendation

Extended Recommendation

Implementation

Evidence base (grading)

References

Discussion points from professionals & user representatives

Introduction

- AFOs are used in combination with footwear («**AFO-footwear combination**»)
- Good dialogue on when and for how long to use AFOs

  6-7 hours daily usage is often reccomended

  →*related to goal setting*
- <u>New AFO:</u> due to growth, change in personal needs

Main recommendation

AFO should be considered in persons with:

impaired standing or walking ability and function,

instability in feet or ankles,

deformities and/or risk of deformities

Strength of main recommendation:
Strong

FOR ALL AGES

Extended recommendation

- ✓ AFOs can **stabilise and protect** ankle and foot joints
- ✓ AFOs can **indirectly influence** proximal joints (knee/hip)
- ✓ In persons with **gait function**, AFOs can
  - improve initial contact & ground clearance
  - correct foot and shank alignment in Crouch gait
  - improve walking speed, step length, energy cost of walking
- ✓ Children may need **new AFOs** every **6-12 months**
- ✓ Users should be provided with written information on AFO usage

Implementation

Indications
Treatment goals
Effect

evaluated with

Clinical assessment
Relevant outcome measures
Gait analysis

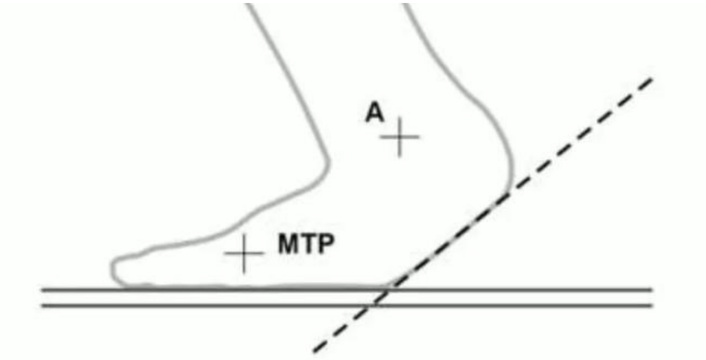
Visual gait analysis insufficient in complex gait deviations

Local fysiotherapist should know how to assess need for adjustments and fitting of new AFO

Information for the orthotist

Bilateral CP
Greater risk to develop crouch – AFOs which limit dorsiflexion

Unilateral CP
In tight plantarflexors (≤5° dorsiflexion with extended knee)
Stabilize midfoot, control dorsiflexion



Dorsiflexion should occur at the **ankle joint**, not through an unstable midfoot

https://www.slideshare.net/slideshow/cga-ifa-2015-14-foot-models/48344073#9

Evidence base

Specifies the research for the recommendations & grades their quality

References

Evidence to decision discussion with:

Clinicians

Define roles in follow up & patient dialog

User representatives

Benefits of AFOs > time & effort

Emphasize individual fitting and adjustments

Need for multiple AFOs, in growth and for different activities

Cerebral parese (NorCP) → Ortoser

NorCP
Kunnskapsbasert retningslinje

metodebok.no

INTRODUCTION

Ankle-foot orthoses(AFO)

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Functional electrical stimulation (FES)

Spinal Orthoses

TOV NTNU

Introduction

Functional electrical stimulation orthosis (FES orthosis) is an alternative to the traditional AFO which prevents foot drop

- requires good **cognitive ability**
- may give **greater acceptance**.

Main recommendation

An FES orthosis may be considered as an alternative to a traditional AFO in individuals with GMFCS level I–II, where foot drop/lack of dorsiflexion during the swing phase is a challenge.

Strength of main recommendation:
WEAK

Extended recommendation

- FES Can be used as a drop-foot orthosis if lift during the swing phase is a challenge and **stance phase stability is satisfactory**.

- FES orthosis is **not suitable** in cases of major malalignments during stance phase or crouch gait.

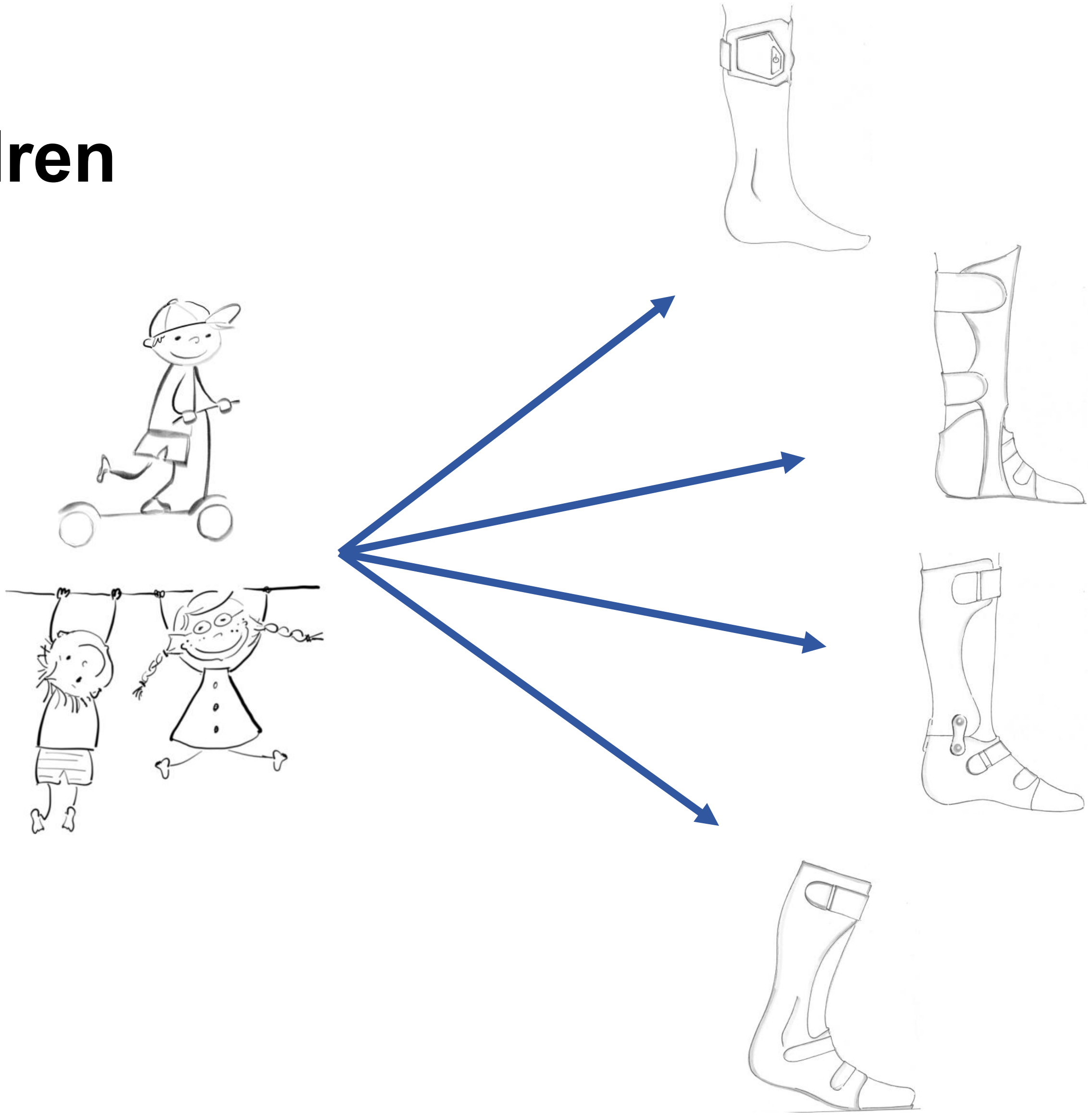
Implementation

- Recommended range of motion is dorsiflexion to at least neutral position with the knee extended.

- Testing of FES orthosis in various settings over a period of time should be possible.

AFO provision for ambulatory children with Cerebral Palsy in Norway

Current practice, evidence and national guidelines



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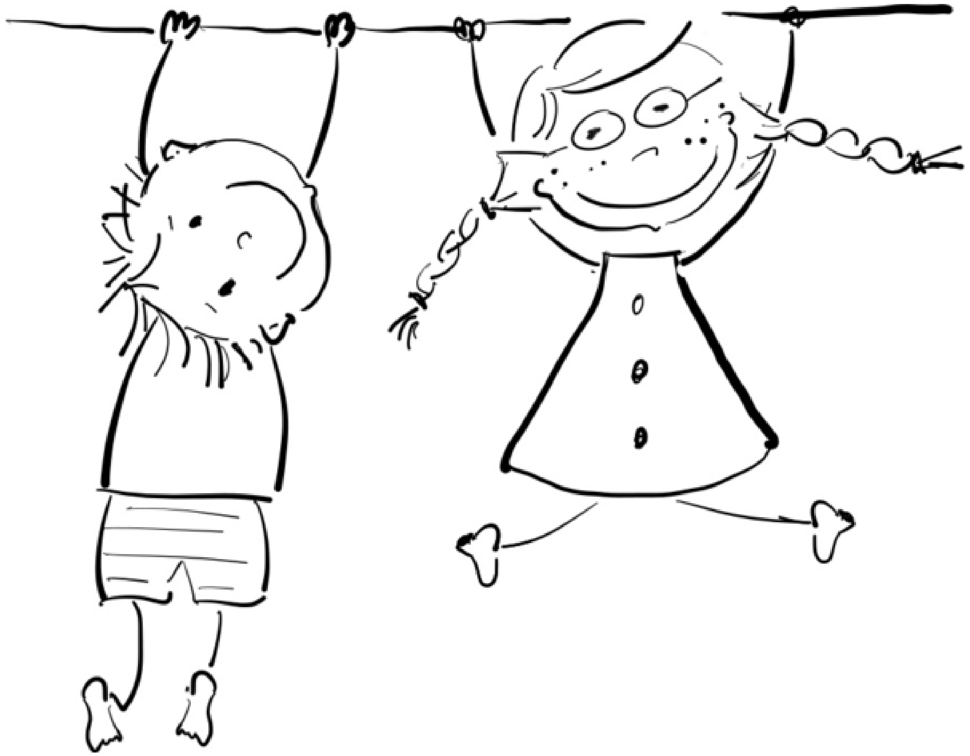

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