The Observance of Biomechanical Effects on the Estimation of Common Ankle Foot Orthoses in Cerebral Palsy

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Overview

1. Goal of Treatment

2. The Physiological Gait

3. Criteria for an Orthotic Fitting

4. Orthosis Types – Nomenclature and Biomechanics

5. Requirements for the Orthotic Fittings

6. Conclusion and Prospects
1. Goal of Treatment

Restoring the Physiological Gait

Effects of the Orthotic Fittings:

- Maintaining the foot in neutral or dorsiflexed position
- Preparing for initial contact
- Stability during stance phase
- Push off [Des]
- Reducing the energy consumption during walking [Bre]
1. Goal of Treatment

Measurement of Physiological Gait

Temporal and Spatial Parameters during Walking [Mor]:

STEP/STRIDE LENGTH

CADENCE [step/minute]

VELOCITY: CADENCE * STEP LENGTH [distance/time]

SINGLE SUPPORT (duration of the unilateral support)

DOUBLE SUPPORT (duration of the bilateral support)
1. Goal of Treatment

The Pathological Gait

<table>
<thead>
<tr>
<th>TYPES OF GAIT ACCORDING TO THE AMSTERDAM GAIT CLASSIFICATION</th>
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<tr>
<td>TYPES OF GAIT</td>
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<tr>
<td>----------------</td>
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<tr>
<td>KNEE</td>
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<td>FOOT CONTACT</td>
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Established at VUmc in Amsterdam [Bec]
Evaluation of foot and knee position in mid stance
Progression to higher gait types possible
Improving the interdisciplinary work on CP patients
Assessing of gait patterns is easy
2. The Physiological Gait

Dividing into Gait Phases [Per, Goe]

Dividing into Rotations around Fixed Points (Rocker) [Owe]
2. The Physiological Gait
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3. Criteria for an Orthotic Fitting

Plantar Flexion
- 1\textsuperscript{st} rocker [Nol]
- heel lever
- neuroplasticity [Hor]

Alignment of the Orthosis
- mid stance
- tuning [Owe]
- adjusting to the path. gait

Range of Motion
- using the remaining mobility
- adjusting to the path. gait
- therapeutic requirements

Spring Force
- 3\textsuperscript{rd} rocker/4\textsuperscript{th} rocker
- adjusting to the path. gait
- push off [Des]

Defined Pivot Point
- 1\textsuperscript{st} rocker/2\textsuperscript{nd} rocker
- qualified physiotherapy [Hor]
- avoiding muscular atrophies
4. Orthosis Types – Nomenclature

Dividing:

1. according to names/definitions?
   brands or general names (DAFO, SAFO, FRAFO, HAFO, SMO)

2. according to mechanical features?
   material thickness (mm), stiffness (Nm/°), spring constant (D), restoring force (-D*s), energy storage

3. according to operating principles?
   dynamic - static [Nov]
4. Orthosis Types - Biomechanical Features

Using internal and external forces

Enabling and locking certain movements

Sagittal: Motion in 2 joints encased in the AFO
  - upper ankle joint
  - metatarsophalangeal articulations

Not only advantages but also disadvantages [Rom]

„One orthosis may not be optimal to address all of the goals.“ [Nov1, S.330]
5. Requirements for the Orthotic Fittings

Adjustable Alignment

Adjustable Range of Motion

Plantar Flexion Possible

* limited movement depending on construction
5. Requirements for the Orthotic Fittings

Variable Spring Force

High Spring Force

Defined Pivot Point

** limited or locked movement
6. Conclusion and Prospects

"One orthosis may not be optimal to address all of the goals." [Nov1, S.330]

Requirements for an Orthotic Fitting:

1. spring force,
2. alignment of the orthosis and
3. range of motion.

All adjustments have to be changeable separately and must not influence each other.
6. Conclusion and Prospects

Prospects:

Great need of research

Are dynamic AFOs able to trigger neuroplasticity in CP patients?
6. Literature:


Many Thanks for Your Attention