Orthotic management of hemiplegia: getting it straight

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Orthotics & hemiplegia: summary points

- Orthoses are sometimes the answer
- Often part of a solution + other interventions
- Sometimes not the right thing at all

✓ Treatment goals & biomechanical objectives are key to evaluating outcomes.
Overview

- Orthoses & how they work?
- What problems occur with hemiplegia?
- Can orthoses help?
- Is orthotic intervention effective?
- Issues from Hemihelp family forum
What are orthoses?

Ortho = straighten or correct

An orthosis is any externally applied device used to modify the structural & functional characteristics of the neuromuscular & skeletal systems.

International Standards Organisation
Biomechanical principles

- Forces & vectors
- Moments & levers
- Pressure
- Stiffness & strength
- Bending
- Friction
- Stability
Forces

Action forces - created by gravity and muscle activity.

Reaction forces - oppose gravity and muscle action, most orthoses work through reaction forces.
Longer levers = less force
Larger area = less pressure
Terminology

✓ Anatomical
   
joints encompassed (e.g. AFO, WHO)

✓ Functional
   
biomechanical effect (e.g. hip abduction)

✓ Nominal
   
inventors name or place of first use

X  vague terms such as dynamic
Orthotic supply process

- Treatment goals
  - Biomechanical objectives
    - Orthosis design & management plan
      - were the biomechanical objectives met?
        - were treatment goals achieved?
Orthotic assessment

- Family expectations and preferences.
- Diagnosis – SCPE classification.
- Severity – GMFCS.
- RoM, strength, selective control, spasticity etc.
- Joint congruency / integrity.
- Any associated complications.
- Any other interventions.
Children with hemiplegia

- Unilateral, usually spastic impairment.
- ~30% children with CP
- Skeletal growth leads to deformity.
- All walk - GMFCS levels I and II (& III?)
Treatment goals

- To improve the efficiency of gait.
- To prevent or correct deformity.
- To improve bi-manual function.
Pre-requisites of normal gait

- Stability of the stance limb.
- Clearance of the swinging limb.
- Appropriate pre-positioning at terminal swing.
- Adequate step length.
- Conservation of energy expenditure.

after J Perry, J Gage
Plano-valgus foot with no equinus
Winters’ classification of hemiplegic gait

- Sagittal plane gait deviations
- Types I - IV
- Increasing severity associated with greater proximal impairment

Winters et al (1987)
JBJS, 3, 437-441
Type I equinus in swing phase - PLS AFO
Type II - equinus stance and swing phase
Type II recommendation - solid AFO

- Long levers
- Large areas
- Flexible forefoot
Type II prescription recommendation - solid AFO
Influence of AFO on ground reaction force
Type III - equinus and knee impairment
Type IV - ankle, knee and hip problems
Equinus associated with inversion
Correcting varus deformity
Measuring for an AFO
Cast preparation
Vacuum moulding polypropylene
Control straps and fastenings
Control straps and fastenings
Forefoot adduction control
Accommodating fixed deformity
Sequence for fitting an AFO
Sequence for fitting an AFO
How long to wear an AFO?

- Recommended 6-8 hours per day.
- Daytime more effective than night to stretch gastrocnemius.
- Not usually worn for sports or in house.
Hinged AFOs?
Leg length discrepancy

- Internal
- External
Troubleshooting

- Rubbing on ankle or over naviculae
  - heat & modify plastic.
  - corrective strapping.

- Rubbing back of heel or AFO not tolerated
  - consider botox +/- casting to ROM
Do AFOs improve function or prevent deformity for children with cerebral palsy?

- Small within-subject comparisons studies.
- Hi-tech outcomes – 3D gait analysis.

✓ Efficacy requires preventing plantar-flexion.

✗ Effectiveness ‘over time’ not measured.

Morris (2002) DMCN 44(3):205-211
Preventing plantarflexion improves:

- Stability in stance
- Clearance in swing
- Stance phase pre-positioning
- Step length
- Energy expenditure

...at least in Winters Type I & II
Manual Ability Classification System - MACS

I handles objects easily and successfully.

II handles most objects but with somewhat reduced quality and/or speed of achievement.

III handles objects with difficulty; needs help to prepare and/or modify activities.

IV handles a limited selection of easily managed objects in adapted situations.

V does not handle objects and has severely limited ability to perform even simple actions.

Eliasson et al DMCN 2006
Wrist Hand Orthoses
Efficacy of WHOs to improve bi-manual function and prevent deformity

- Not well established.
- Could be assessed in combination with constraint-induced therapy.
Issues from Hemihelp online forum

- DAFOs (supra-malleolar foot orthoses)?
- Neurological insoles?
- Silicon AFO?
- Boots for infants?
- Poor communication & understanding of goals.
Orthotic outcomes

‘the ideal orthosis replaces function, is weightless, invisible and costs nothing.’

Lehneis (1993)
Is the treatment goal achieved?

the worst orthoses

impede function, are cumbersome,

unsightly and expensive.
Orthoses and cerebral palsy

- Occasionally the answer
- Often part of the solution + other interventions
- Sometimes not the solution at all
- Define treatment goals / biomechanical objectives
Paediatric Orthotics

Eds. Morris & Dias

Mac Keith Press 2007

Chapter 9

Orthotic management of CP

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