

Leg orthoses for polio and post-polio syndrome: numerous innovations, limited evidence

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Program

- 1 **Background** - *Introduction and Aims of the presentation*
- 2 **Prescribing leg orthoses** - *The role of gait analysis*
- 3 **Innovative technological advancements** - *Studies on the effectiveness*
- 4 **Conclusion** - *Key points*
- 5 **Questions**

1. Background

Introduction

- Orthotic treatment in the context of rehabilitation medicine, is a frequently applied intervention to promote mobility.
- Yet, although the widespread application of leg orthoses suggests an evidence-based intervention, this is not supported in the literature.

1. Background

Introduction

- The need for such support, however, increases, because new and costly technologies become available.



1. Background

Aims of the presentation

- Discuss some issues surrounding the process of prescribing leg orthoses.
- Talk the about the role of instrumented gait analysis in this process.
- Present some results on the effectiveness of innovative orthotic advancements.

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2. Prescribing leg orthoses

Indications for orthoses

- Leg orthoses are often prescribed in patients with polio and other causes of non-spastic pareses.
- Aim: improve walking or standing.
- At the same time, the orthosis should hamper walking as little as possible.

Indications for orthoses

Complaints?

yes no

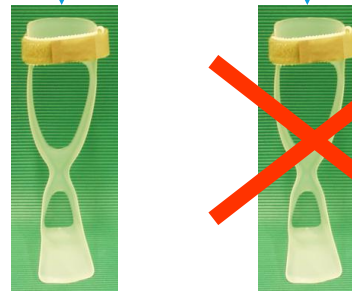
Related to standing/walking?

yes no

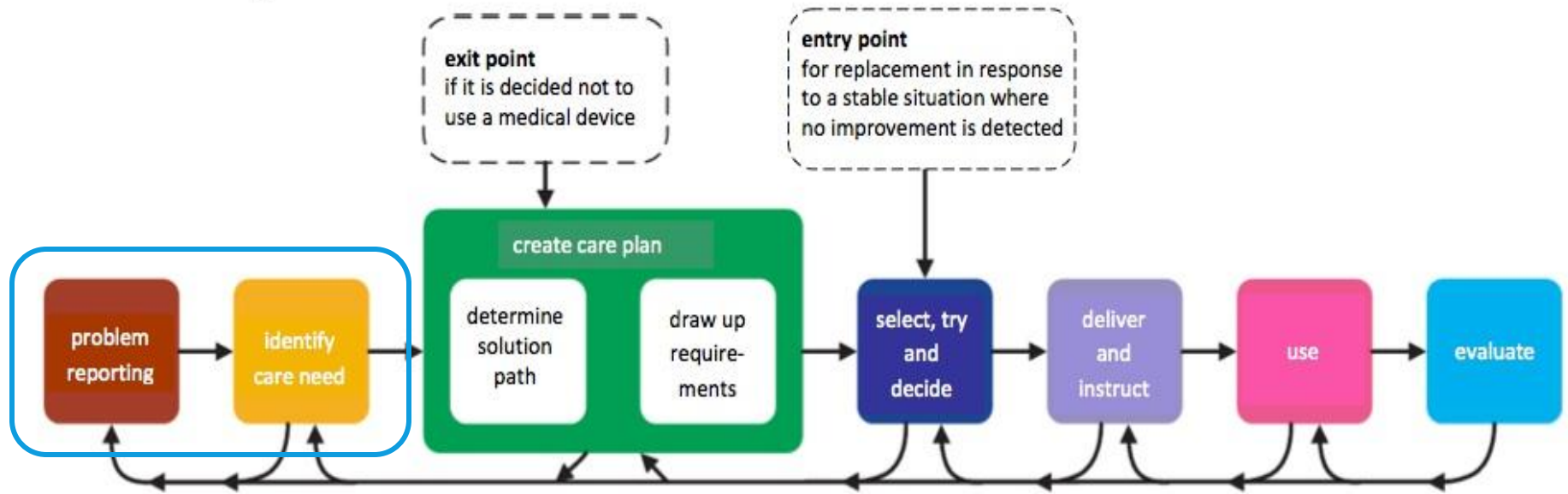
Orthosis possible?

yes no

Motivated?



Process description for medical devices

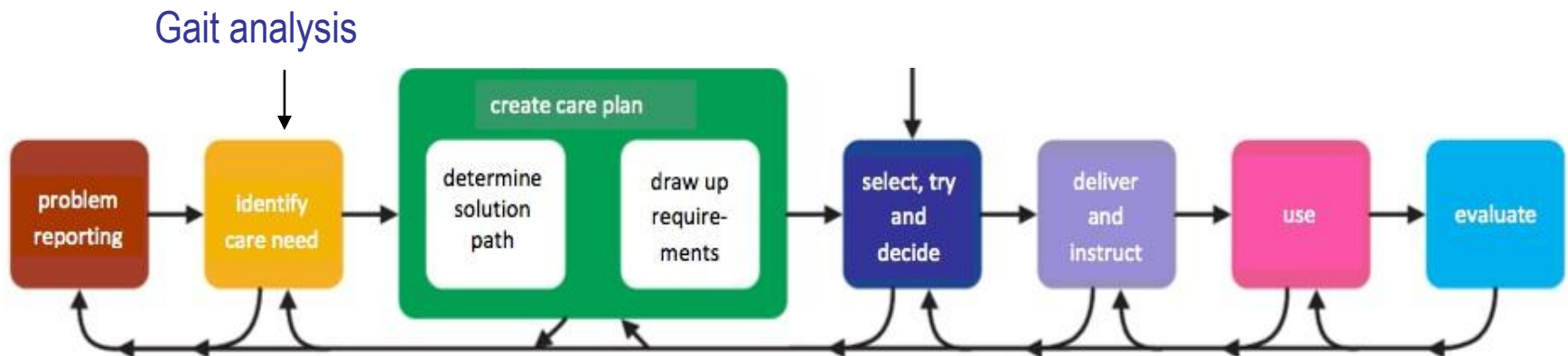




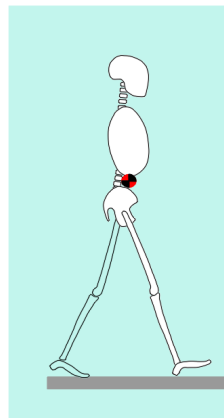
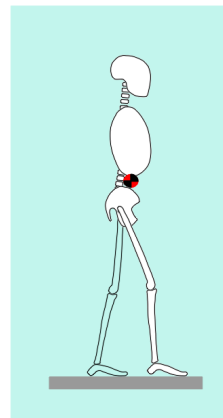
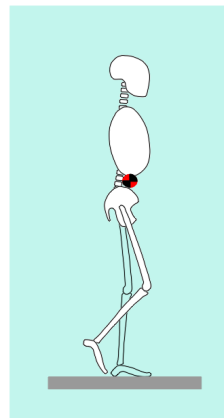
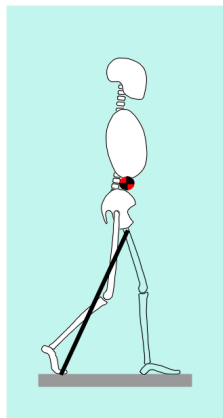
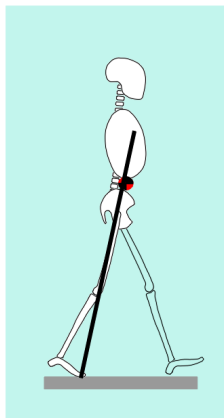
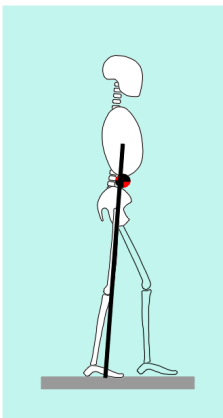
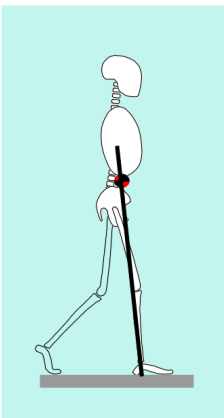
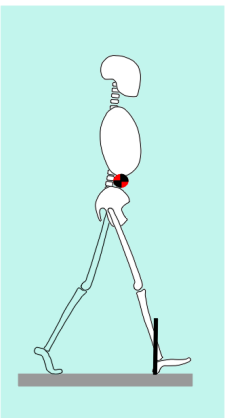
2. Prescribing leg orthoses

The role of gait analysis - 1

- Gait analysis can be used as a tool to systematically observe and describe the gait pattern.
 - determine the gait abnormalities underlying the impairments
 - help guide treatment decisions







Initial contact

Loading response

Mid stance

Terminal stance

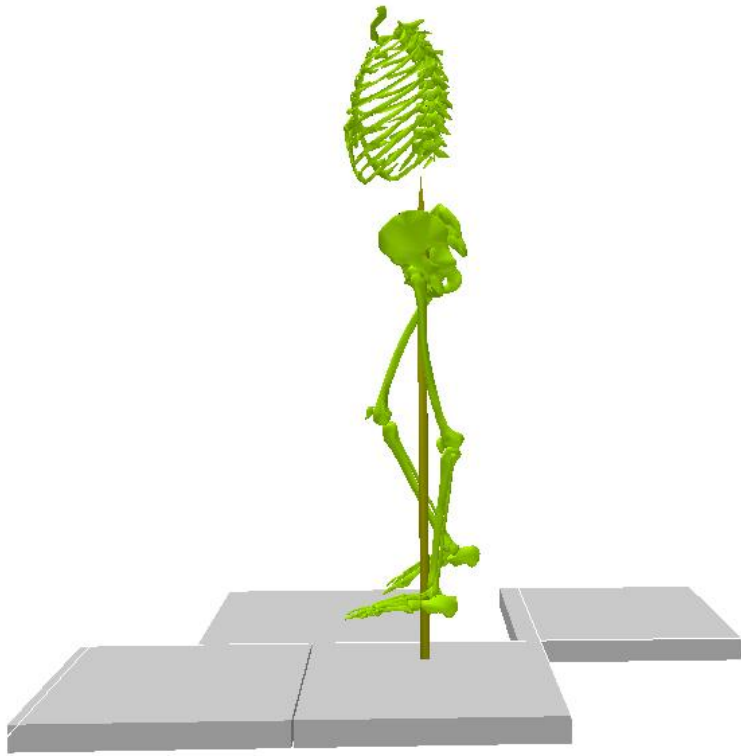
Pre swing

Initial swing

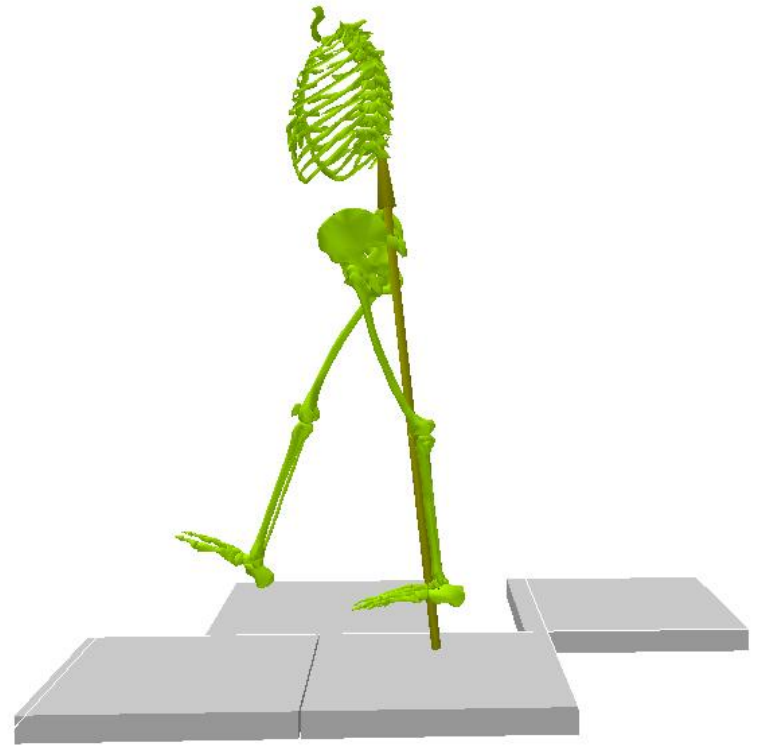
Mid swing

Terminal swing

QuickTime™ en een
-decompressor
zijn vereist om deze afbeelding weer te geven.

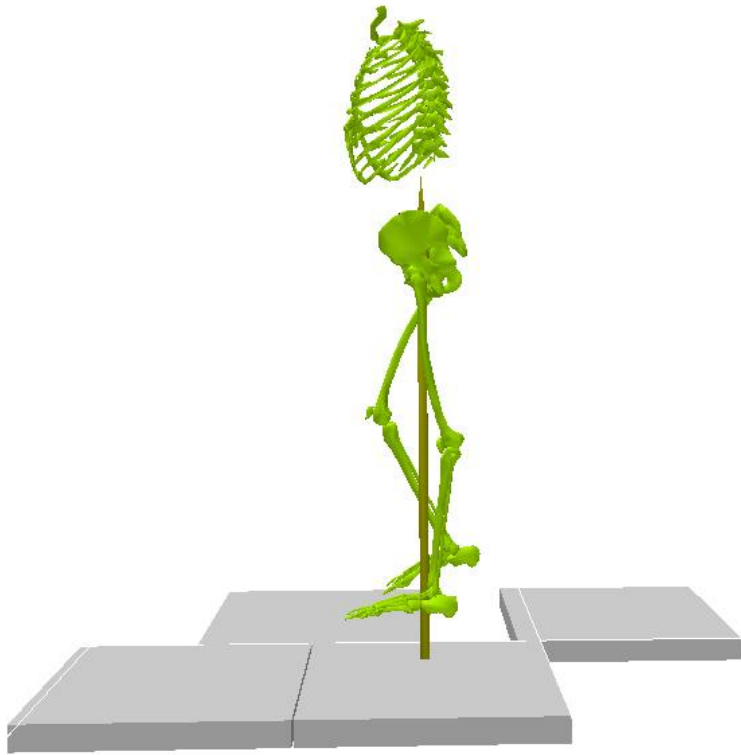


Mst

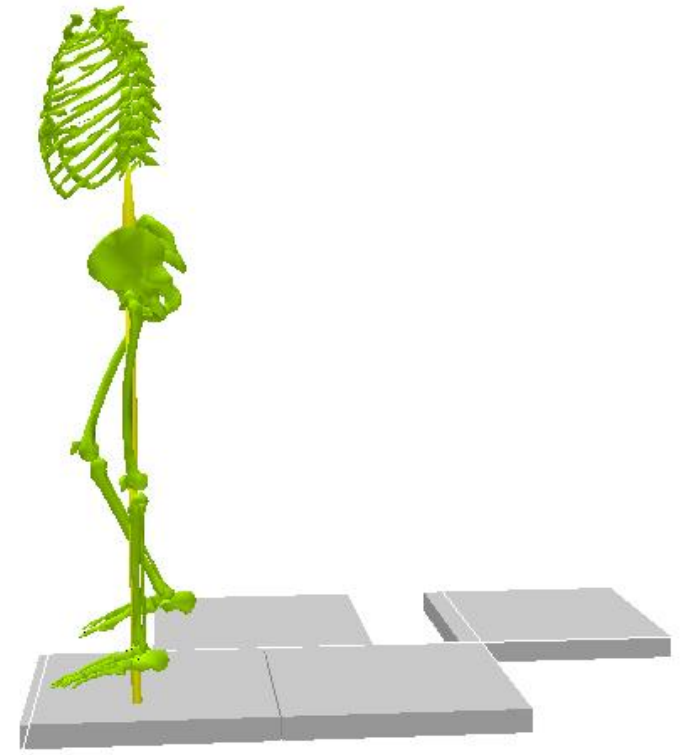


Tst

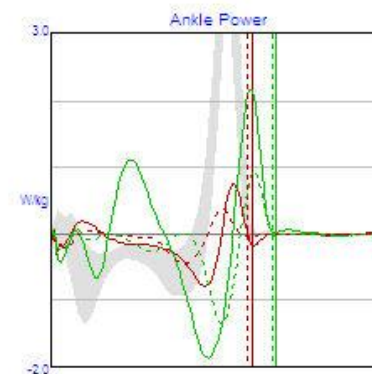
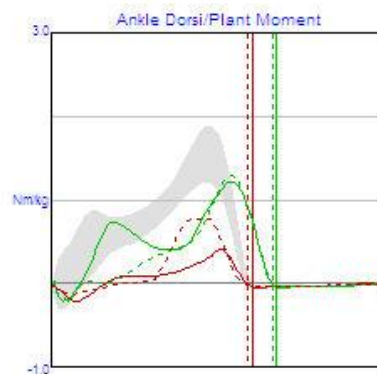
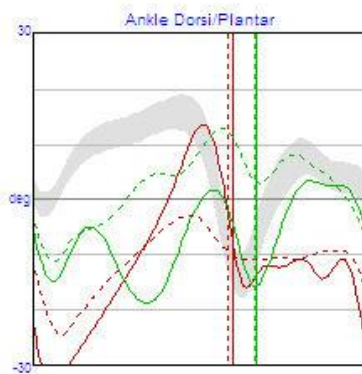
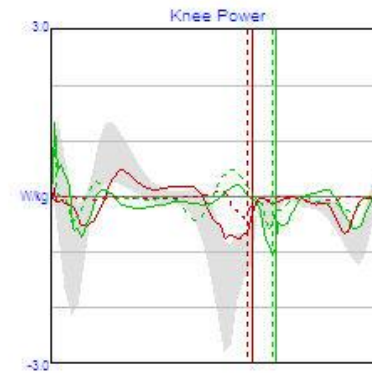
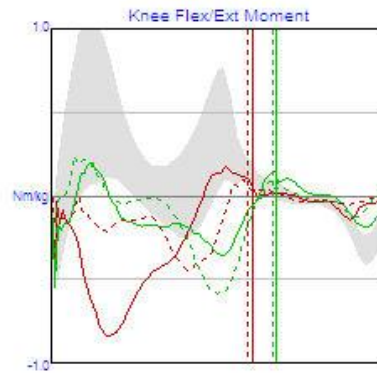
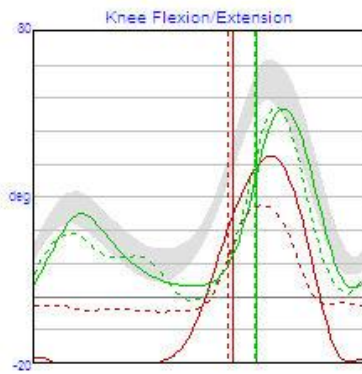
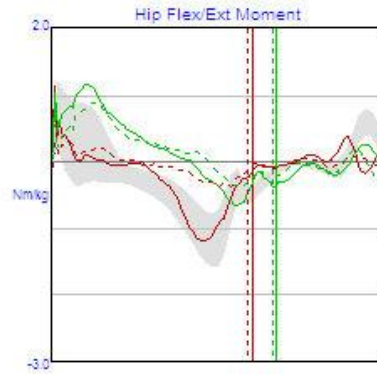
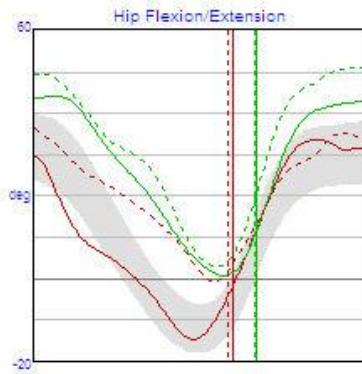
QuickTime™ en een
-decompressor
zijn vereist om deze afbeelding weer te geven.



Mst: schoe condition



Mst: SC-KAFO condition

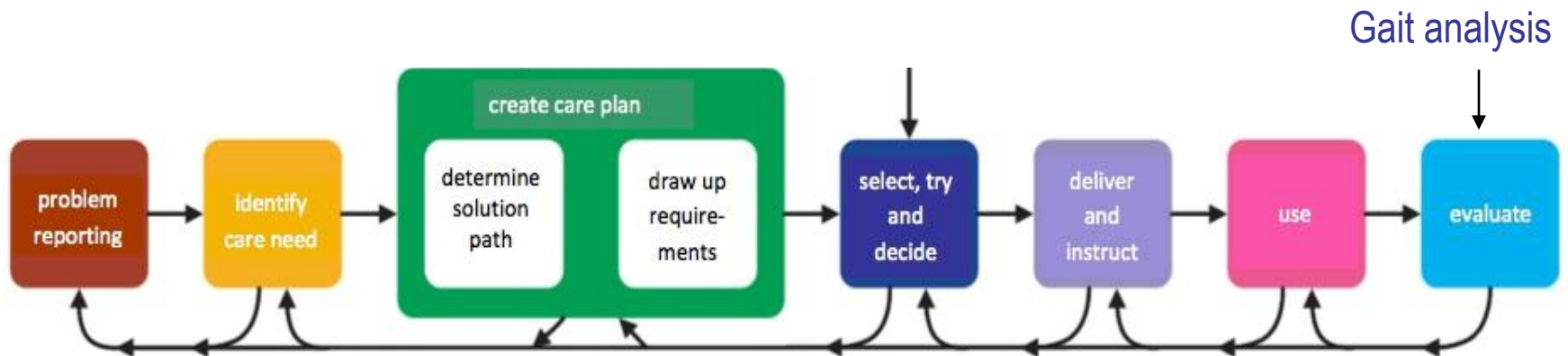


Oude conditie08.c3d Left Oude conditie08.c3d Right SC-KEVO13.c3d Left SC-KEVO13.c3d Right

2. Prescribing leg orthoses

The role of gait analysis - 2

- Gait analysis also enables determining the biomechanical efficacy of an orthosis (evaluation).
- These outcomes, can, subsequently, be related to the clinical effectiveness (*Harlaar et al 2010; Brehm et al 2011*).



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-

3. Innovative technological advancements

Study on the effectiveness - 1

- Use of prepreg carbon composite shelf materials.
- **Why?**
 - very strong, stiff and lightweight
 - enables a full-contact fitting
- **Advantages:** (*Brehm et al 2007*)
 - allows a more optimal correction of the gait pattern
 - reduces energy cost of walking
 - increases patient satisfaction



Methods



Subjects

20 former polio patients (13m, 7f)
age 52 y (SD, 9.2); weight 72 kg (SD, 11.8)

Design

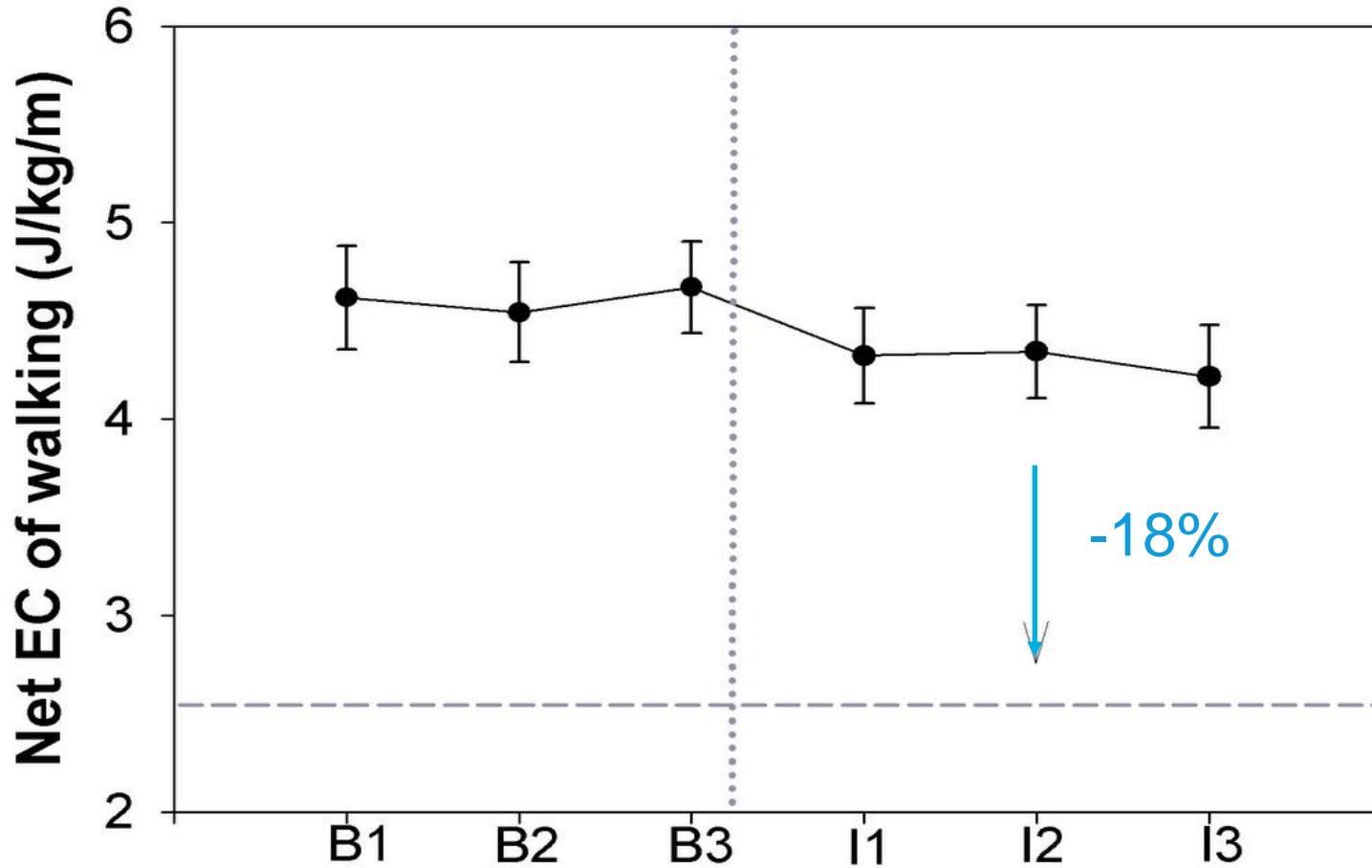
Prospective multiple baseline and follow-up design:
3 baseline measurements: -6, -4, -2w pre-intervention
3 follow-up measurements: 4, 12, 26w post-intervention

Baseline: polyprop or metal KAFO with locked knee joint
Follow-up: carbon composite KAFO with locked knee joint

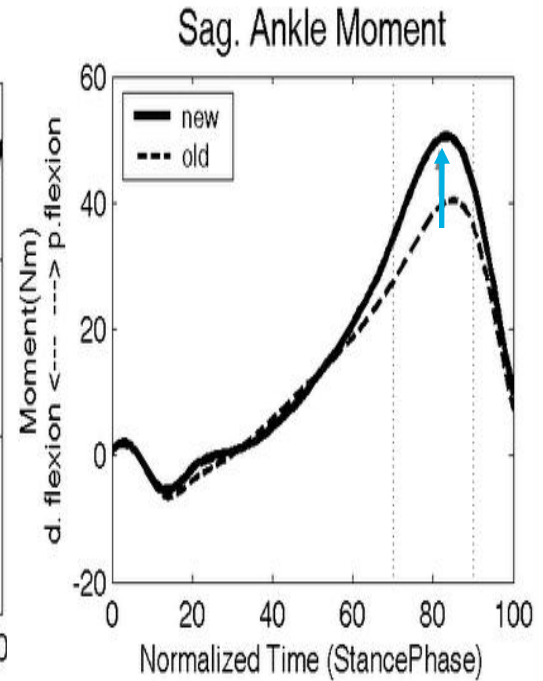
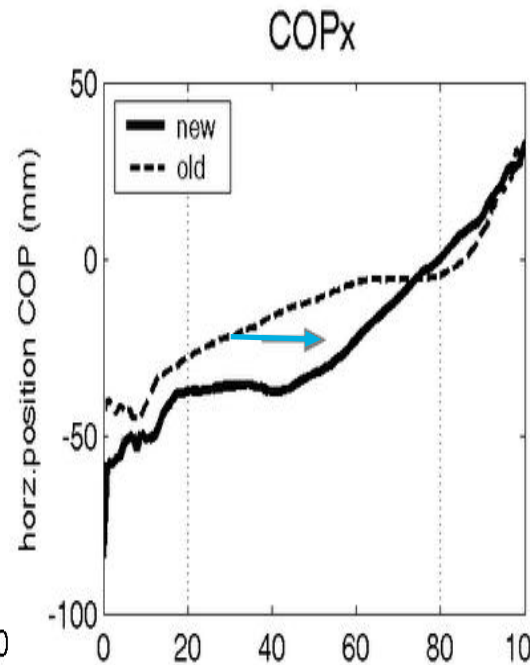
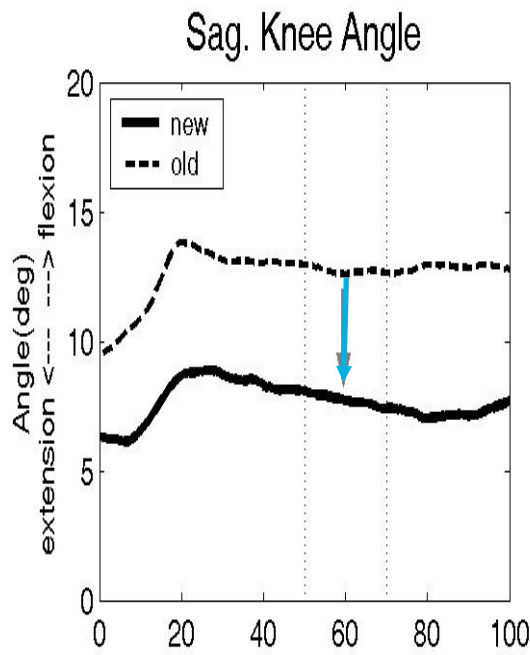
Outcome measures

1. Energy cost (EC) of walking (J/kg/m)
2. 3D-gait pattern parameters
3. Physical functioning (SF36)
4. Satisfaction score

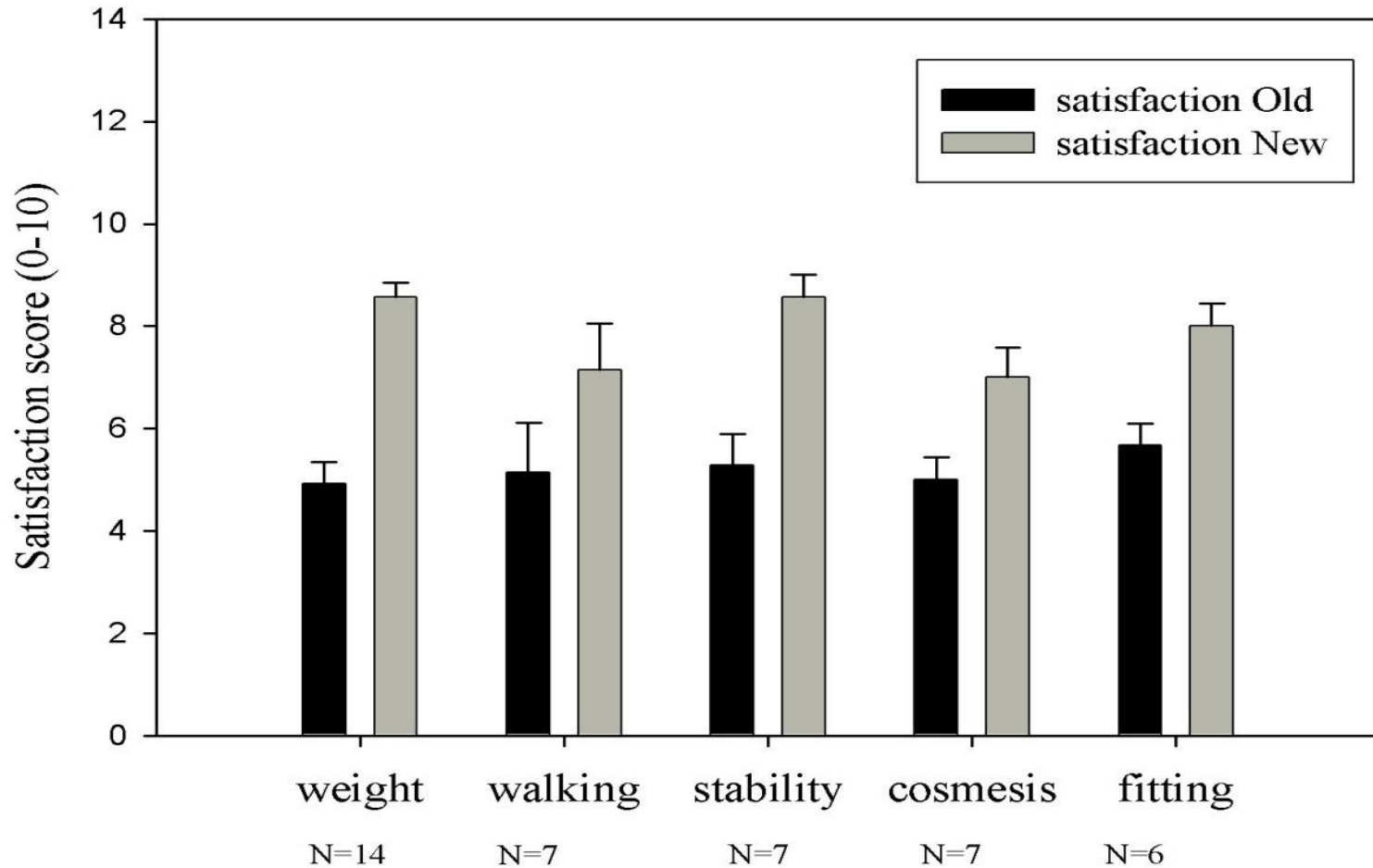
Results 1: energy cost (primary outcome)



Results 2: gait pattern



Results 3: satisfaction



J Rehabil Med 2007; 39: 651–657



ORIGINAL REPORT

EFFECT OF CARBON-COMPOSITE KNEE-ANKLE-FOOT ORTHOSES ON WALKING EFFICIENCY AND GAIT IN FORMER POLIO PATIENTS

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From the ¹Department of Rehabilitation Medicine, VU University Medical Center, ²Department of Rehabilitation, Academic Medical Center, University of Amsterdam and ³MOVE Institute for Human Movement Research, VU University Medical Center, Amsterdam, The Netherlands

3. Innovative technological advancements

Study on the effectiveness - 2

- Use of stance control knee joints.
- **Why?**
 - allows flexion of the knee during swing
- **Advantages:** (*Zacharias B, Kannenberg A, 2011*)
 - reduces energy cost of walking
 - reduces compensatory movements
 - improves patient satisfaction (looks better)





locks

unlocks

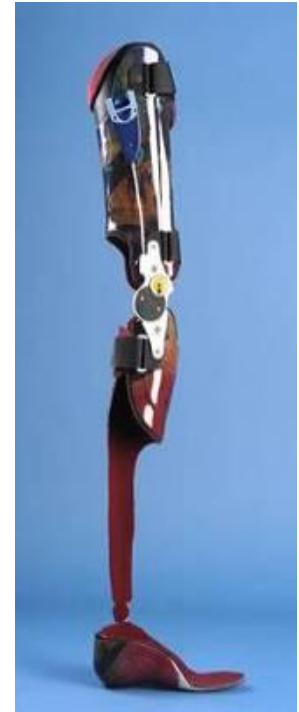
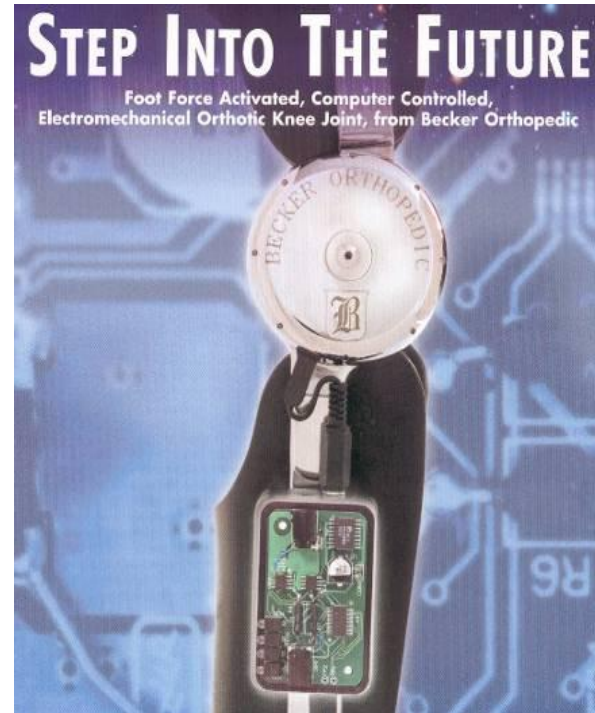
Mechanical SC knee-joints

- Requires full extension in terminal swing, and an extension moment at the end of stance.



Electronic SC knee-joints

- Requires an extension moment at the end of stance.



Methods *(Sabelis et al ISPO 2007; Van Schie et al ESMAC 2009)*

Subjects

- 8 former polio patients with quadriceps paresis
- 5 Swing phase lock (SPL; Basko Health Care)
- 2 E-knee (Becker Orthopedic)
- 1 Free Walk (Otto Bock)

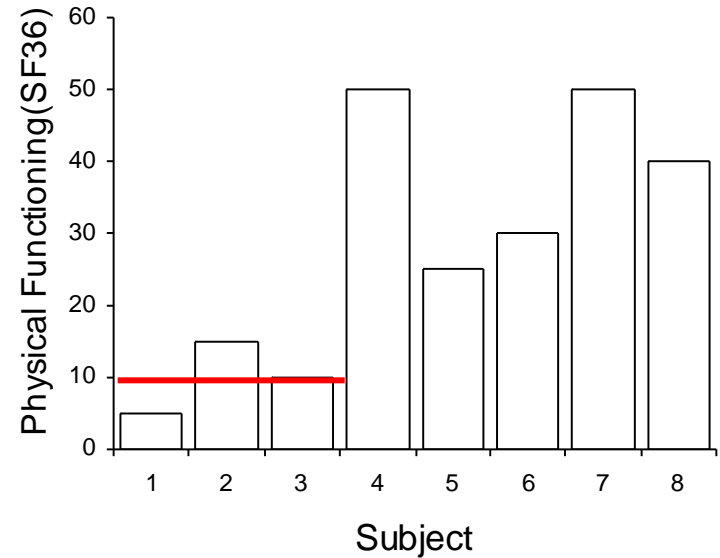
All patients received instructions and training from an experienced physiotherapist after SC-KAFO delivery.

Outcome measures

- Questionnaires to evaluate the subjective experience (motives for (non)use, comfort and functioning) with the SC-KAFO.
- 3D-gait pattern parameters (internal knee moments)
- Physical functioning (SF36-PF)

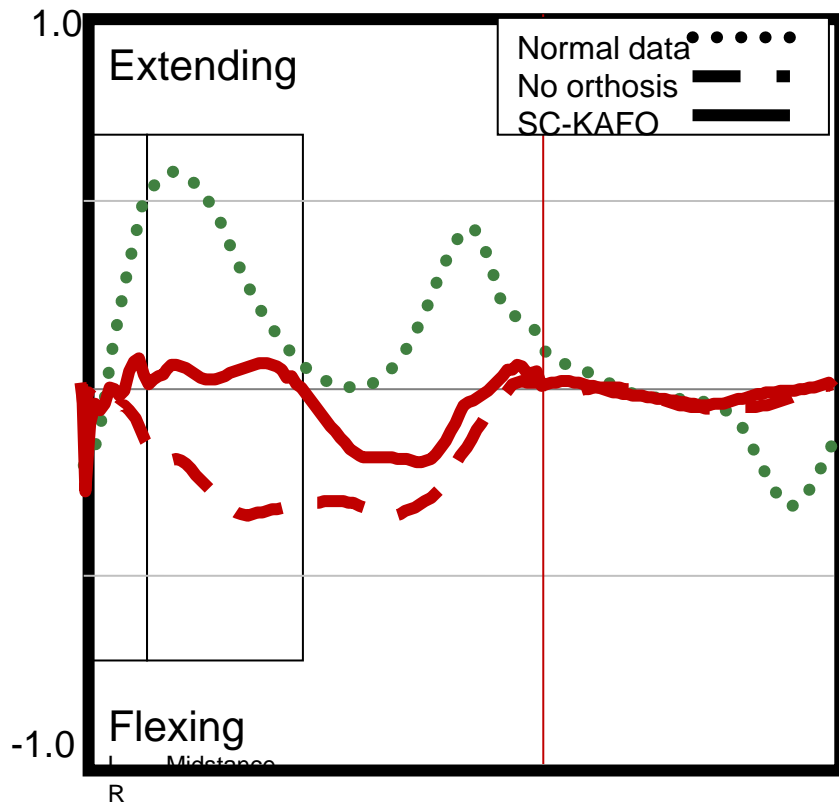
Results 1: satisfaction and physical functioning

Subj	Age (Years)	Strength sum	Use	Hinge	Walking aid	Legs affected
1	61	10.0	-	SPL	walker	2
2	70	21.0	-	SPL	cane	2
3	76	15.0	-	SPL	2 canes	2
4	55	21.5	+	SPL	cane	2
5	61	15.0	+	SPL	none	2
6	75	23.5	+	FW	none	1
7	50	20.0	+	E-knee	none	2
8	53	19.5	+	E-knee	none	1

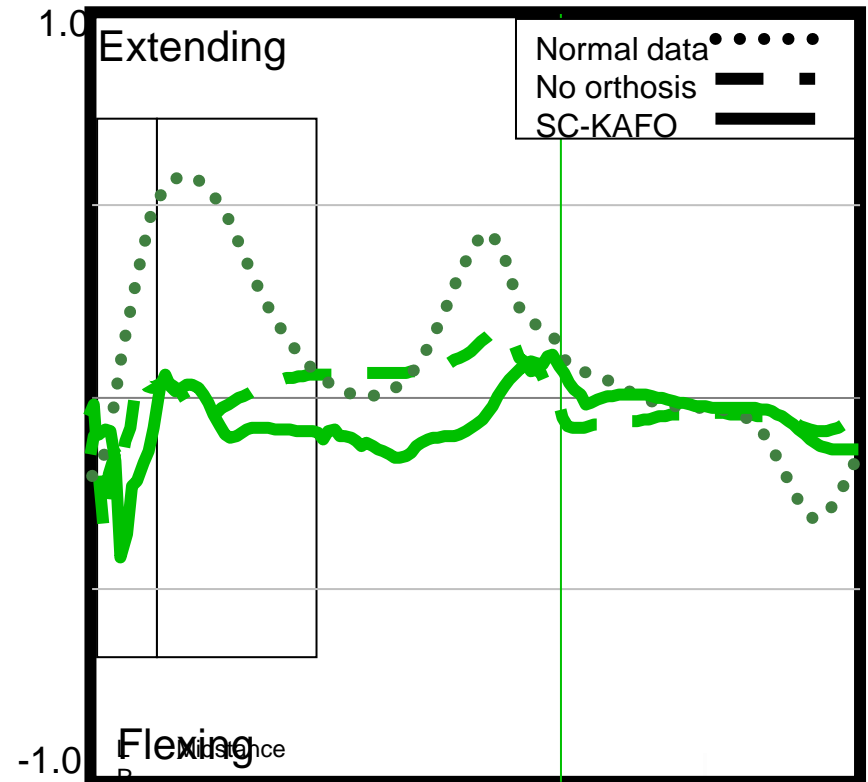


Results 1: gait pattern (internal knee moments)

Knee Flex/Ext Moment (Nm/kg)



Knee Flex/Ext Moment (Nm/kg)



Program

1 **Background** - *Introduction and Aims of the presentation*

2 **Methods** - *Prescribing of leg orthoses*

3 **Results** - *Effectiveness of leg orthoses*

4 **Discussion** - *Conclusion and Key points*

5 **Questions** -

4. Conclusion

Conclusion

- More research is needed to determine the effectiveness of (different types) of leg orthoses in polio and PPS.
- Preferably, multicenter studies should be conducted.
- Furthermore, core sets of outcome measures, to be used in orthotic studies on AFOs and KAFOs, should be agreed upon. (*Brehm et al 2011*)

4. Conclusion

Key points

- Despite innovative technological advancements, studies on the effectiveness of leg orthoses in polio are scarce.
- Improvement of orthoses reduces the EC of walking, which may improve functioning of patients with PPS.
- Multicenter studies and the use of core sets are advocated to increase the evidence for the effectiveness of orthoses.



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