Roessingh Research and Development

Innovatiecentrum Revalidatie Technologie

Institute for Research in Rehabilitation Medicine and Technology

DYNAMIC BALANCE CONTROL IN TRANSFEMORAL AMPUTEES; INDIVIDUAL CONTRIBUTION OF THE PROSTHESIS SIDE

AIMS

A major goal in the rehabilitation of lower limb amputees is to regain effective postural control. Particularly in transfemoral amputees this requires complex adaptation strategies in both the prosthesis side and the non- amputated side (Cerniecky 1996, Serroussi 1996). This study explores the use of a new developed method (van der Kooij 05) to assess the Dynamic Balance Control (DBC). Unlike previous methods using weight distribution as a measure of balance, this method determines the individual contribution of both legs to postural control during perturbations.

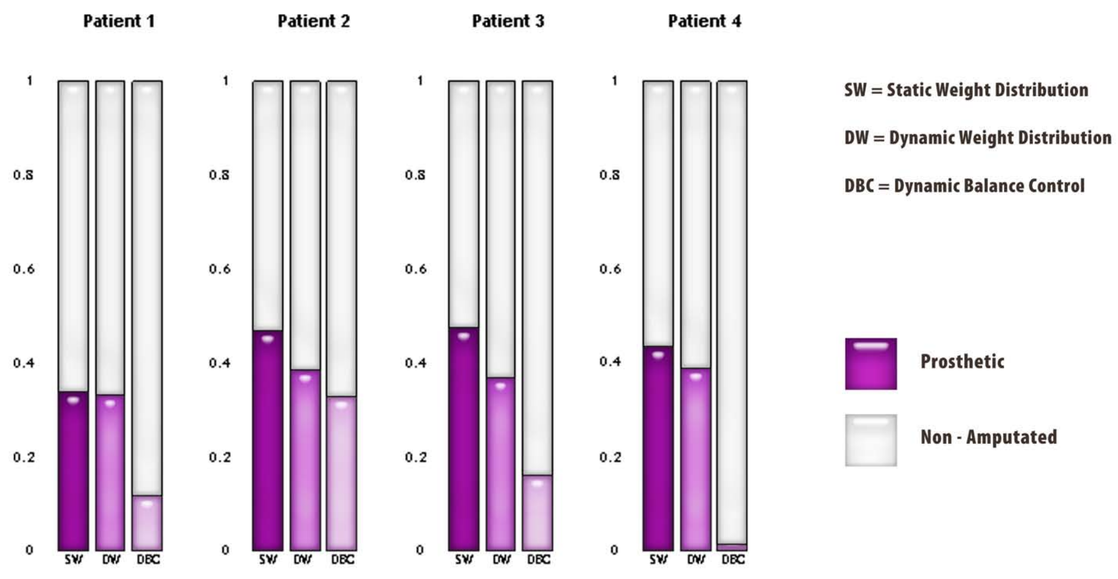
METHODS

Four unilateral transfemoral amputees were included. Subjects stood on a force platform mounted on a motion platform and were instructed to stand still. The experiment consisted of 1 static and 3 perturbation trials of 90 seconds each. During the static trial the platform did not move. During the (dynamic) perturbation trials, balance responses were elicited by continuous random sagital platform movements consisting of a multiple sine signal (ranging from 0.06-2.37 Hz).

Weight distribution during the static (SW) and the dynamic perturbation trial (DW) were calculated by dividing the average vertical force below the prosthesis foot by the sum of forces below both feet. The Dynamic Balance control (DBC) represents the ratio between the stabilizing mechanism of the prosthetic leg to the stabilizing mechanism of the non-amputated leg. The stabilizing mechanism is calculated from the corrective ankle torque (assessed with inverse dynamics) in response to sway (assessed by the movement of CoM) and averaged over all the perturbation frequencies.

RESULTS

All patients showed a clear asymmetric weight baring in favor of the non- amputated leg (see figure). However the DBC ratio showed that the contribution of both legs to balance control was even more asymmetric



dynamic balance control versus static and dynamic weight bearing

CONCLUSIONS

The contribution of the prosthetic leg to balance was much smaller than its contribution to weight bearing. This implies that the contribution of the prosthetic leg is not a mere reflection of the weight distribution. This method could help to evaluate a lower limb amputee's ability to compensate for the loss of his leg and the necessity for (and efficacy of) balance training.

Furthermore, the method could clarify whether the introduction of more advanced prosthetic legs lead to a greater contribution to balance of the prosthetic leg.

Authors

M.J.Nederhand, MD, PhD 1

EHF van Asseldonck, MSc 2

H van der Kooij, MSc, PhD 2

1 Roessingh Research and Development, Enschede, the Netherlands

2 Institute for Biomedical Technology, University of Twente, Enschede, The Netherlands