

Author

Hahn, Andreas (Vienna AT) | Dr.

Otto Bock Healthcare Products GmbH - Clinical Research & Services

Title

On the (Im-)possibility to predict who may benefit from a microprocessor controlled prosthetic knee component

Coauthors

Lang M, Stuckart C

Summary

We investigate the classifying and predictive power of a variety of clinical variables to understand which parameters may characterize successful responders to MPK trial fittings. The findings should allow to exclude unsuitable parameters.

Introduction

With the availability of microprocessor controlled prosthetic knee components in the mid 1990`s advanced function based on controlled knee flexion under load and swing control became available. Those components were presumed to preferentially suit more mobile amputees despite early evidence suggesting at least equal benefit to lower mobility grades [1]. Recent research confirms the latter [2,3,4]. Often, however, access to such technology is denied on clinical rationales with sometimes uninvestigated presumptions.

Methods**OBJECTIVE**

We investigate an extended set of clinical variables on their potential to predict an individual`s capability to utilize functional benefit provided by an advanced hydraulic microprocessor controlled exo-prosthetic knee component.

Based on data from trial fittings with Genium (Ottobock Healthcare Products GmbH, Austria) gathered in Germany a retrospective cohort analysis is performed. Performance assessment categories included functional benefits [1], subjects perception and advanced maneuvers. Prosthetists and subjects assessments are noted in 5 point-Likert or dichotomized scales. The set of clinical variables includes age, mobility grade, etiology, body mass index (BMI), comorbidities, residual limb condition, socket type, previous fitting etc.. Analysis is implemented

via linear and logistic (uni- and multivariable) regression models. Effect size estimates and quality of the regression models allow an estimate of predictive power.

Results

A cohort of 899 individuals, age 49.0 ± 12.9 ys; BMI 26.6 ± 4.6 ; mobility grade classification MG2: 12.5%, MG3: 64.1%, MG4: 22.8%; etiology: 68.9% trauma, 15.4% tumor, 6.0% vascular disease; and predominantly male (83%) was investigated. Amputation level was transfemoral in 80.1% and knee-disarticulation in 18.9% of the subjects. Subjects were experienced prosthetic walkers having their first prosthesis since 21.2 ± 15.6 ys. 78% had at least one comorbidity. Most sensitive performance indicators per category were [# hits with $p < 0.05$): variably gait speed (22), toileting (18) and stairs ascend (29). Effect estimates span up to 0.37 (mobility grade, $p < 1E-26$!) but regression models fail to reveal predictive power in any of the investigated variables nor their combination (univariable $r^2 < 0.19$, multivariable $r^2 \leq 0.263$). BMI failed to reach statistical significance.

Figure 1. Compound measure of functional benefit depending on mobility grade rating. The effect of mobility grade is insufficient to predict individual response.

Conclusion

The statistical significance of the findings is remarkably high. While all clinical effects are plausible, none of the investigated variables (nor their combination) exhibit predictive power. This corresponds to earlier findings [3, 5, 6].

Based on the size of this sample we conclude that the investigated variables themselves may not be suitable to judge on an individual's potential to benefit from an advanced MPK and hence must be dismissed as both: predictors as well as indicators for denial [7].

References

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Image: Hahn On the (Im-)possibility_2094.png

