STEP COUNT ACCURACY OF THE STEPWATCH AND FITBIT® ONE™ AMONG INDIVIDUALS WITH A UNILATERAL TRANSTIBIAL AMPUTATION

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INTRODUCTION

Daily step counts, as obtained via activity monitors, provide insight into real-world activity level (Albert, 2013). For persons with lower-limb amputations, the StepWatch (Modus Health LLC) has historically been the most widely used monitor. The StepWatch is costly, though, making its use prohibitive for many clinicians (Albert, 2013; Fulk, 2014). The FitBit® One™ (Fitbit Inc.) is a lower cost option. However, accuracy assessments of both monitors are limited among individuals with lower-limb amputations. This study's purpose was to (1) evaluate the step count accuracy of both monitors during forward, linear walking and more complex walking and (2) compare monitor step counts during real-world walking.

METHOD

Participants: 50 prosthetic users, aged 18-85 years, with a unilateral transtibial amputation were included in this IRB-approved study. Participants were excluded if they had any current issues with overall health or their residual limb that limited their walking ability or if they had an amputation of the sound limb.

Procedures: Participants were equipped with a StepWatch and FitBit® One™ secured about the distal prosthetic pylon. Participants completed a clinical evaluation that included the 6 Minute Walk Test (6MWT) to evaluate forward, linear walking accuracy, and the Figure of 8 Walk Test (F8WT) and 4 Square Step Test (FSST) to evaluate complex walking accuracy of the two monitors. An investigator, blinded to the activity monitor counts, manually counted steps taken during the 6MWT and F8WT/FSST. After each test, step counts recorded by each monitor were extracted, and monitors were reset. Following this evaluation, participants were sent home with the monitors and told to perform their regular activities, wearing the monitors at all times. Monitors were mailed back after a 7-day period.

Data Analysis: Percent errors and intraclass correlation coefficients (ICC[2,1]) with 95% confidence intervals (CIs) were used to evaluate the accuracy of the StepWatch and FitBit as compared to a manual step count for the 6MWT (forward, linear walking) and F8WT/FSST (complex walking). The absolute percent error was calculated as ((abs(Monitor – Manual)/Manual)* 100). Once monitors were returned after the 7-day data collection, the total step count recorded by each monitor was extracted, and the absolute percent difference was calculated (abs((SW-FB)/((SW+FB)/2))*100). Finally, a linear regression was used to evaluate associations between the monitors' total real-world steps counts.

RESULTS

Of the 50 participants, a subset participated in part 1 of the study. For part 2, participants were excluded if they did not wear one or both monitors for at least five days or there was device failure, resulting in n=42.

Table 1: Step Count Accuracy Data.

	6MWT Manual	*6MWT SW*	*6MWT FB*	*Complex Manual*	*Complex SW*	*Complex FB*
n	31	31	27	17	17	16
Avg. Step Count	361.6 ±137.8	358.8 ±137.1	346.9 ±150.9	56.7 ± 23.0	56.8 ± 25.9	57.7 ± 28.3
Avg. % Error		4.3 ± 9.2%	4.3 ± 9.2%		13.0 ± 12.2%	15.5 ± 26.5%
ICC (LB, UB)		0.99 (0.98, 0.99)	0.97 (0.93, 0.99)		0.90 (0.75, 0.96)	0.88 (0.69, 0.96)

Both monitors showed excellent accuracy based on percent errors and ICCs during forward, linear walking (Table 1). During complex walking, percent errors were higher; ICCs were excellent but CIs were large. During real-world walking, the absolute percent difference was 25.4±28.6%, but monitor step counts had a nearly perfect linear relationship, with the StepWatch consistently counting an almost fixed number of additional steps over the FitBit (SW= 0.985FB + 4588.6, R^2=0.972).

DISCUSSION

Both monitors accurately counted steps during forward, linear walking, with high ICCs and average percent errors well below the 10% threshold considered acceptable (Lee, 2014). The StepWatch appeared to outperform the FitBit during complex walking, but percent errors exceeded the acceptable threshold and large CIs suggest a larger sample is needed. Real-world step count discrepancies were high, yet these step counts were highly associated.

CONCLUSION

The StepWatch and FitBit are accurate in for forward, linear walking. The StepWatch appears more accurate during complex walking, but more research is needed. The FitBit consistently counted fewer steps than the StepWatch during real-world walking.

CLINICAL APPLICATIONS

The StepWatch appears to be an acceptable tool for assessing real-world activity level among individuals with transtibial amputations. The FitBit, which under-counts steps but is less costly, may be used to estimate real-world activity level.

REFERENCES

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