The Effectiveness of the DOD/VA Mobile Device Outcomes Based Rehabilitation Program (MDORP) for Service Members and Veterans with Lower Limb Amputation

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INTRODUCTION

According to recent estimates, there are nearly two million people with lower limb amputation (LLA) currently living in the United States.[1] This number is expected to double by 2050.[2] Within the military, combat operations during the global war on terror have led to more than 1,700 service members (SMs) undergoing major limb amputation, with the majority experiencing LLA & many sustaining proximal and multiple limb loss.[3] Those with LLA due to trauma are at a higher risk than non-amputees for multiple secondary health effects, which include joint pain, osteoarthritis, chronic lower back pain, & cardiovascular disease. [4,5]

In order to mitigate these adverse secondary health effects, optimize long-term function, & increase quality of life in individuals with LLA, effective rehabilitation and innovative life-long care is essential. Therefore, the Veterans Affairs (VA) & Department of Defense (DoD) implemented a program through the Joint Incentive Fund called the Mobile Device Outcomes-based Rehabilitation Program (MDORP). The primary objective of this pilot study was to determine if the implementation of MDORP improved strength, mobility, & gait quality in SMs and Veterans with LLA.

METHODS

17 SMs and Veterans with LLA (12 males & 5 females; mean age = 39.5 yrs; 12 with unilateral transtibial amputation, 4 with unilateral transfemoral or knee disarticulation, & 1 with bilateral transtibial amputation) were enrolled & trained to use the Rehabilitation Lower Limb Orthopedic Analysis Device (ReLOAD). The ReLOAD system (Figure 1) provided participants with real-time assessment of gait deviations, subsequent corrective audio feedback, & individualized exercise prescription for normalizing gait at home and in the community.

After baseline testing, functional prosthetic gait, & exercise training by a physical therapist (PT) (Figure 2), participants took home the ReLOAD system and completed an 8-week walking and home exercise prescription-based program. This home exercise program was individually based on gait deviations identified by the ReLOAD system. Subjects were visited by a PT every two weeks in the home(Figure 3). PTs were able to monitor walk and exercise compliance remotely via secure web portal and participants returned after eight weeks for retesting.

References:
1. Ziegler-Graham K, MacKenzie EJ, Ephraim PL, Travison TG, Brookmeyer R. Estimating the prevalence of limb loss in the United States: 2005 to 2050. Arch Phys Med Rehabil. 2008;89(3):422-9.
2. Varma P, Stineman MG, Dillingham TR. Epidemiology of limb loss. Phys Med Rehabil Clin N Am. 2014;25(1):1-8.
3. Group TRoIwLLAW. VA/DoD Clinical Practice Guidelines for Rehabilitation of Individuals with Lower Limb Amputation. In: Department of Veterans Affairs, Defense Do, editors. https://www.healthquality.va.gov/guidelines/rehab/amp/: Department of Veterans Affairs; 2017. p. 1-123.
4. Robbins CB, Vreeman DJ, Sothmann MS, Wilson SL, Oldridge NB. A review of the long-term health outcomes associated with war-related amputation. Mil Med. 2009;174(6):588-92.
5. Gailey R, Allen K, Castles J, Kucharik J, Roeder M. Review of secondary physical conditions associated with lower-limb amputation and long-term prosthesis use. J Rehabil Res Dev. 2008;45(1):15-29.

FIGURE 1. Rehabilitation Lower Limb Orthopedic Analysis Device (ReLOAD)

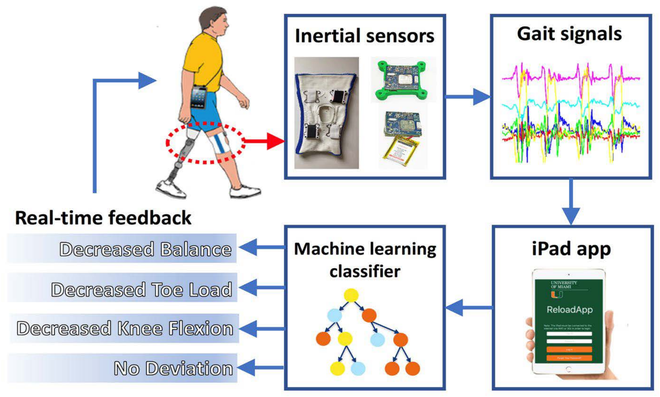

FIGURE 2. Baseline testing and functional prosthetic gait training by PT

FIGURE 3. Subject home visit

RESULTS

At the 8-week intervention follow-up assessment, participants demonstrated significant improvements in residual limb hip extensor strength (p = 0.001), sound limb hip extensor strength (p = 0.003), AMPPro score (p = 0.04), 6MWT distance (p = 0.003), & CHAMP score (p = 0.001). Also, they demonstrated significantly fewer observational gait deviations (5 vs. 3 deviations, p = 0.007). Lastly, performance improved during the turn to sit component of the cTUG toward the prosthesis. Significant differences in 10mWT velocity & self-perceived mobility & balance were not found at the 8-week assessment.

Table 1. Differences in Outcomes for those who participated in the MDORP Program (n = 17)

	Baseline Mean ± SD (range)	Post Intervention Mean ± SD (range)	Effect Size	p-value
Residual Limb Hip Strength (pts)	26.7 ± 6.6 (15 – 40)	33.8 ± 5.0 (27 – 40)	**1.07**	**0.001**
Sound Limb Hip Strength (pts)	35.5 ± 5.6 (23 – 40)	37.7 ± 3.8 (30 – 40)	**0.40**	**0.03**
AMPPro (pts)	42.9 ± 2.7 (37 – 46)	43.9 ± 1.6 (41 – 47)	**0.35**	**0.04**
10mWT (m/s)	1.0 ± 0.2 (0.79 – 1.30)	1.1 ± 0.1 (0.84 – 1.28)	0.27	0.23
6MWT Distance (m)	512.2 ± 102.0 (313.04 – 674.55)	566.6 ± 75.5 (443.20 – 714.60)	**0.53**	**0.003**
Observational Gait Deviations (count)	5 ± 2 (1 – 6)	3 ± 2 (0 – 7)	**0.85**	**0.007**
CHAMP Score (pts)	18.2 ± 7.8 (7 – 28)	21.4 ± 6.0 (13 – 33)	**0.41**	**0.001**
PLUS-M (T-score)	55.8 ± 7.0 (43.9 – 67.1)	57.4 ± 5.9 (47.7 – 71.4)	0.24	0.20
ABC (% Score)	81.1 ± 22.0 (16.88 – 98.75)	82.0 ± 17.6 (30 – 98.75)	0.04	0.86

CONCLUSIONS

The overarching goal of the MDORP program was to develop a comprehensive mobile rehabilitation program that was clinician guided and incorporated the use ReLOAD. ReLOAD augmented the prosthetic & exercise training that the participants received in the clinic, through real-time audio feedback gait correction at home along with the prescription-based exercise program to address the most prominent gait deviations and functional impairments. Preliminary MDORP results are promising in its ability to improve basic and high-level mobility, lower limb strength, and gait quality in a group of SMs and Veterans with LLA. In addition, “booster” prosthetic training may be justified in an effort help maintain an active lifestyle, promote prosthetic use, and mitigate secondary health effects.

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