

Evaluation of an app for vestibular rehabilitation of older adults with motion controlled games and remote monitoring

Paulien Roos¹, Michael Rossi¹, Austin Mituniewicz¹, Katherine Marschner¹, Nathan Pickle¹, Timothy Zehnbauer¹, and Susan Whitney²

¹CFD Research Corporation, Huntsville, AL, USA

²University of Pittsburgh, PA, USA

Introduction

- 50% of people > 60 years old experience vestibular dysfunction [1]
- Vestibular rehabilitation can reduce dizziness and falls [2]
- Successful rehabilitation relies heavily on home based exercises
 - Adherence to exercises typically < 50% [3]
 - Exercise quality unknown to clinicians

Research Aim

Develop an app with gaming elements and remote monitoring to improve adherence of older adults to vestibular rehabilitation

Vestibular Therapy

- Most common exercise is the visual ocular response level 1 (VORx1). It requires a patient to focus on an object arm length away while shaking their head as fast as possible (Figure 2)
- Therapy exacerbates patient symptoms, which often discourages them from performing their exercises as they should



Figure 2

Results

Metrics

No statistics performed due to small sample size. DHI scores ranged between 24 and 72 (mean: 46, SD: 18.5). RoM and velocity averages and peaks for experiment found in Table 1.

Survey

At least 50% of the subjects responded “partially agree” or better to all of the categories with the most positive categories being the app’s ease of use and enjoyment of the games (Figure 3).

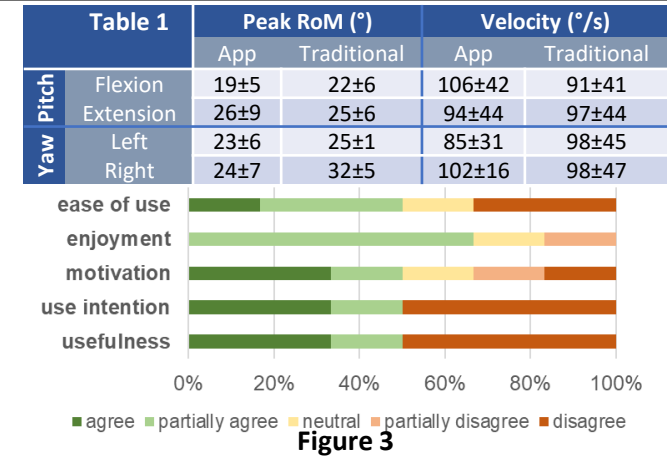


Figure 3

Vestibular Rehabilitation App

- Games with adjustable parameters that mimic balance and VORx1 (Figure 1)
- Exercise and game instructions
- Clinically validated questionnaires (DHI [4], Activities based Balance Confidence scale (ABC) [5])
- Games have varying levels of visual complexity (Figure 1)
- Games controlled by a Texas instruments SensorTag inertial measurement unit (IMU) fixed to the head using an elastic band and sacrum using a belt

Developed with Felgo (<https://felgo.com/>)

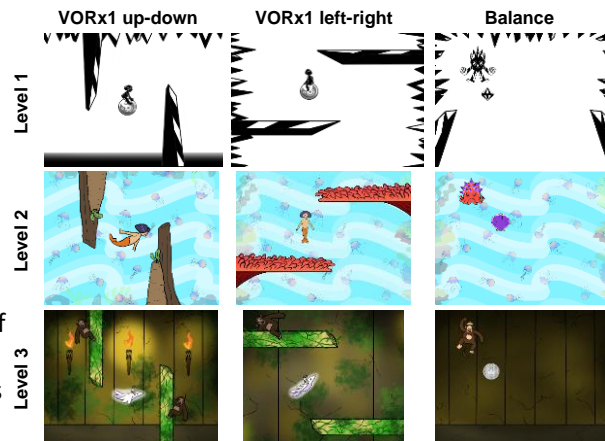


Figure 1

- Sensor orientation computed using the Madgwick algorithm [6]

Methods

- 6 women (>65 years old) undergoing vestibular rehabilitation used the app after providing written informed consent (IRB approval by the University of Pittsburgh)
- Subjects performed VORx1 exercises normally and while using the vestibular rehabilitation app
- Sensor data was analyzed on app to determine local peaks for RoM (measured against starting position each trial) and velocity for the direction of interest (pitch: flexion-extension | yaw: left-right)
- Local peaks averaged across trial and sent to SQL database
- After data collection, patients completed a dizziness handicap inventory (DHI) [4] and answered a questionnaire to evaluate ease of use, enjoyment, motivation, use intention, and usefulness

Discussion and conclusions

- This pilot study demonstrated that performing vestibular exercises using a gaming app yields similar results to normal exercises performed in clinic
- Patient responses will be used to further improve user satisfaction of the app
- First successful implementation of gaming in vestibular rehabilitation for older adults

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Contact

paulien.roos@cfrc.com

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