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Evaluation of a Low-End VR Setup for CROM Assessment

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Extended Abstract

The interest in providing health services remotely has been growing in recent times, especially since the global pandemic caused by COVID-19 [1]. Telemedicine solutions can provide access to medical services from the patient's home, without requiring a visit to the hospital. This saves time, increases comfort for the patient, and avoids the risk of contracting nosocomial diseases. Studies have shown that the patient satisfaction with remote treatments can be comparable to traditional face-to-face treatments, and that they prefer the combination of remote treatment and face-to-face treatment versus only face-to-face treatment [2]. One of the most prevalent musculoskeletal problems worldwide is neck pain. Neck pain is classified as a disabling disease which up to 50% of the general population will suffer at some point in their lives [3]. To make a correct diagnosis and treatment plan for the neck, physicians rely on the Cervical Range of Motion (CROM). CROM characterizes the functional state of a joint by measuring the number of degrees it can move along its planes of motion. In the case of the neck, these are 3 planes: sagittal for the flexion-extension movement (FE); transversal for the rotation movement (ROT), and frontal for the lateral flexion movement (LF).

In a previous study we have shown that a high-end Virtual Reality (VR) setup (HTC™ Vive Pro Eye®) can be a reliable tool to perform remote CROM assessment [4]. We designed a VR application that gives instructions, both visual and auditory, which the user must follow to carry out the CROM assessment procedure. The positioning information of the Head Mounted Display (HMD) was used to quantify CROM in each of the three planes [4]. This setup is expensive, needs to be connected to a powerful computer to work, and needs at least two beacons placed in the room. The goal of this study is to find out if a lower-end HMDs based on inside-out tracking that operates without the need for a PC or beacons (Meta™ Quest® 2) could also be used to assess CROM. We ported the CROM assessment application to the Meta™ Quest® 2, and then we conducted a reliability study using a sample of 15 asymptomatic young volunteers recruited from the university. A single rater evaluated each subject twice following the same protocol as in [4]. The average CROM values obtained were FE=115.92º±18.69, ROT=143.54º±13.15, and LF=95º.05±15.81; in the previous study with the high-end HMD the measures obtained were FE= 118.43º±18.23, ROT=140º.32±19.32, and LF=96º.77±14.62. Statistical test showed no differences between the measurements of both devices. To assess the reliability of the low-end HMD, the Intra-class Correlation Coefficient was calculated between the two assessments of each subject. The values obtained were 0.90 for FE, 0.90 for ROT and 0.91 for LF; in the previous study with the high-end HMD the values obtained were 0.92 for FE, 0.88 for ROT and 0.95 for LF; therefore, the reliability of both devices for CROM assessment is quite similar. These result show that the low-end HMD can also be used as a CROM assessment tool.

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