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Research Article

Applicability of immersive virtual reality for training with the myoelectric prosthesis in upper extremity amputated patients: "A clinical case report"

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Introduction

The integration of Virtual Reality (VR) in the rehabilitation process of the upper extremity amputee patient reinforces motor learning, facilitates the incorporation of the prosthesis in the body scheme, and normalizes global gesturing. Real-time biofeedback in scenes and games with motor actions also related to Activities of Daily Living (ADLs), allows the patient to perform a motor gesture with motivating objectives that allow the execution of actions and assess their performance.

Objective

The main objective was to favor the obtainment of gestures and prosthetic control through VR for their incorporation into functional patterns in ADLs in an amputee patient who uses a myoelectric prosthesis (PM).

Materials and methods

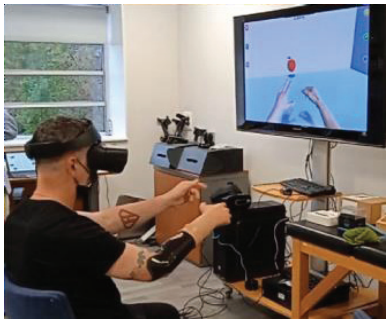
A 46-year-old patient with a transradial amputation of the right upper extremity, the user of PM Michelangelo (Ottobock). The software designed by Carlos III University of Madrid (UC3M) was used with connection to the "Oculus Rift S" glasses. The session lasted 30-45 minutes (according to tolerance), before the VR the training was carried out for correct prosthetic management, executing different grips, tweezers, and combined movements.

The progression of each exercise was performed in the following order:

1. Healthy hand.
2. Prosthetic hand.
3. Bimanual.

The work with VR was carried out in 2 phases:

F1-Exploration and adaptation to virtual space



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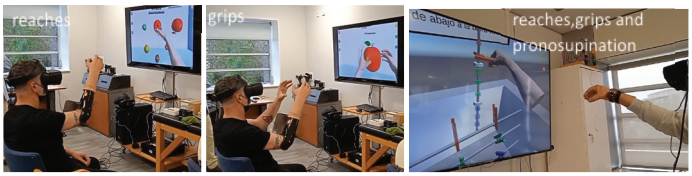
F2 Gesture training and prosthetic control for grips and reaches



Results

The application of VR in combination with conventional treatment offers significant benefits in functionality, learning of correct motor execution in real-time and on the motivational and emotional state in amputees of upper extremity carriers of the myoelectrical prosthesis, shortening training times and improving the integration of the prosthetic limb in the body scheme. In turn, VR through visual and auditory feedback allows objectifying the gains and knowing the evolution in the exercise program and adapting the level of difficulty at all times with the level of achievement obtained.

Discussion

The use of VR in combination with conventional treatment in the rehabilitation of the amputee patient with PM shows to have benefits on functionality [1], following the results obtained in neurological pathology: spinal cord injuries, stroke [2,3], and traumatic shoulder pathology [4-6].

Conclusion

The playful nature of VR with an important motivational component and adherence to treatment facilitates certain motor learning, unlike conventional rehabilitation where the method is usually more monotonous. Although VR shows a beneficial effect, more studies of high methodological quality are needed to delve into the changes produced concerning cortical reorganization and neuroplasticity on motor recruitment, as well as to determine whether these results are maintained over time. It is necessary to define the type of VR used (immersive, non-immersive, semi-immersive), the frequency, intensity, and time of the session that can be individualized [3,7,8], so as not to cause discomfort due to overexposure or fatigue (visual disturbances, headaches, postural pain, etc) in the use of VR devices.

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