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Exercises for the Superior Members through the Kinect Program in Muscular Dystrophy Carriers

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Abstract

Muscular dystrophy is a genetic disease characterized for its notable progression and for the degeneration of the muscle fibers, for that reason the physiotherapeutic treatment consists in enhance and/or keep the muscle strength, prevent muscle contractures and deformities, therefor keeping superior limbs functional. Based on the concepts presented, evaluating how much can weakness and fatigue intervene on the functionality of the superior limbs was the main goal of the research. To this end, two functionality scales were used: Functional Independence Measure and Fugl-Meyer. The evaluation was done before and after the proposed intervention. This is an unprecedented study, since this kind of intervention in patients was not found in any bibliography. The patients went through active freestyle exercises provided by Microsoft's program Kinect, in which many interactive, stimulant games are available, and demand those patients to do precise movements in a playful way, therefore assisting on the physiotherapeutic recovery. The exercises chosen in the research were "Kinect Sport" and "Your Shape Fitness". The researcher intervened throughout 10 weeks, two times a week, hence 20 sessions total, each session during 40 minutes long, afterwards all patients were examined. After the analyzes of the available data, evidence was shown that the Kinect has positive and meaningful results for the improvement of the superior limbs.

Keywords: Muscular Dystrophy, Kinect, Active Exercises, Muscle Strength and Functionality.

1.0 Introduction

Muscular dystrophy is a progressive disease and is characterized by degeneration of the musculature, clinically the patient presents muscular atrophy, with progressive decrease of muscle strength and with affection, usually, symmetrical[1]. One of the most frequently reported symptoms in patients with Muscular Dystrophy is fatigue, which is a determining factor for the inactivity of these individuals. Of every 2,000 live births, one is a carrier of some type of muscular dystrophy [2], they are of hereditary origin, but each one has its peculiar, genetic and phenotypic alterations. We have already mapped genes responsible for more than 30 forms of dystrophies, whose inheritance may be autosomal dominant, autosomal recessive and linked to the X chromosome [3].

The treatment is disease control and not curative. The treatment causes the disease not to progress (do not worsen), which would occur if no treatment was done, improving the living conditions of people with dystrophies [4]. The work contains active exercises free of the Microsoft program of the brand Kinect, which has interactive games for this type of stimuli. Currently video games use physical interaction devices with the user, they are called "Exergames", games that at the same time are a form of exercise [5]. On November 4, 2010 Kinect was launched in the USA, and arrived in Brazil on November 18, 2010. The use of Kinect as a tool to help patients in different areas represents a huge range of possibilities, which is set in motivation for the application of this research and the proposals of continuity [6].

The Measure Independence Functional (MIF) and Fugl-Meyer (EFM) scales were the methods used in the research. The Measure Independence Functional (MIF) was an instrument developed in 1980 and only translated to Brazil in 2000, for the follow-up of patients in the rehabilitation phase. It aims to quantitatively evaluate the patient's functional performance through a set of 18 tasks such as self-care, transference, locomotion, sphincter control, communication and social cognition, which includes memory, social interaction and problem solving [7]. The Fugl-Meyer Rating Scale (EFM) was developed and introduced in 1975 by Fugl-Meyer. This scale was the first quantitative instrument for sensorimotor measurement and is currently the most well-known scale used for research and / or clinical practice [8].

Therefore, the present study aims to evaluate the functionality of upper limbs in individuals with muscular dystrophy using virtual reality (KINECT) and two scales, MIF and Fugl-Meyer, aiming at the degree of muscle weakness and fatigue.

2.0 Justification

According to the information gathered in the research, DM muscular dystrophy is a progressive disease, characterized by degeneration of the musculature. Through the clinical signs presented in Muscular Dystrophy, the rehabilitation with use of games presents effectiveness in the treatment and in the inclusion of the patient to the therapy. The results indicate that games have much to offer in the area of rehabilitation, in which the importance of design is fundamental for patient adherence to treatment and for promoting improvements in the movement of body segments [9]. Based on this concept, rehabilitation with the use of Kinect aims at functional quality. In addition, Kinect provides a great opportunity to streamline treatment and

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relieve the stress and routine of conventional physiotherapeutic treatment.

3.0 Objective

3.1 General

The physiotherapeutic objectives are to decrease contractures, maintain and / or improve strength, fatigue resistance and functionality. Fatigue is a common symptom and the main determinant of inactivity [10]. In addition to enabling the acquisition of possible movements, balance and general coordination, delaying muscle weakness, correcting postural alignment, balancing muscle work, avoiding fatigue, developing the contractile force of respiratory muscles, and controlling respiration by correct use of diaphragm, prevent early muscle shortening. Therefore the main objective to be achieved is the improvement of quality of life and functionality. The quality of life of an adult can be improved by increasing their independence [11].

3.2 Specific

The objective of the study was to evaluate the effect on range of motion, muscle strength and upper limb function in individuals with Umeral Muscular Dystrophy submitted to the active exercises stimulated by the interactive games of the XBOX Kinect.

4.0 Materials and Methods

The research is a pilot study, at the Physiotherapy Clinic of the University of Nove de Julho (UNINOVE), in the city of São Paulo-SP, from February to June 2013. Approved by UNINOVE COEP under protocol nº 420031, which established the principles for research on human beings, who agreed and signed the free and informed consent form. Ten adult participants, over 18 years of age, were selected, all of whom were male with a diagnosis of muscular dystrophy, included in the physiotherapeutic treatment of the UNINOVE Clinic of the Vila Maria Unit. The study is a convenience sample for the execution of the scientific initiation and graduation work of the Physical Therapy Graduation. After the selection of the patients, they were previously oriented and adapted to the exercises, which could be performed both in sedation and in orthostatism and that included the stimuli provided by the X-BOX.

To perform the interactive exercises were used the games: Kinect Sports, Your Shope Fitness, Kinect program of the Microsoft brand. The Kinect is an equipment connected to the XBOX 360, which uses a motion sensor that are used from the skeleton of the patient: poses and gestures [12].
The studies were started using two scales of evaluation; Functional independence Measure (FIM) and Fulg-Meyer Scale. The intervention of the researcher occurred in the period of 10 weeks, totaling 20 sessions, performed twice a week, each session with a time of 40 minutes, after this period the patients were reevaluated. The choice of the game was previously studied, regarding the disease, and the type of exercise regarding the need of each patient, without leading to any muscle discomfort and fatigue. It is important to mention that these suggested exercises were performed in an active free manner, without any mechanical device with load. Once selected, the game was taught to the patient and the positions needed for the treatment were monitored by the researcher during the course of the game. In playing, the patient performed continuous and repetitive movements, as already mentioned without leading to muscle fatigue.

Patients were exposed to minimal risks during the research, where they were supervised at all times by the researcher who was standing next to them, if they presented imbalance, fall, fatigue, dizziness or some kind of malaise, the intervention would be interrupted immediately. Free and resisted active exercises should be performed with few repetitions intended to maintain functionality and delay physical deformities. Active exercises are proposed, requiring contractions of a muscular group reducing, so that during the execution of the movements the severity and the weight of the segment act as resistance for the worked muscle group [13].

The patient should be able to actively locate and move his main joints, in an analytical or functional way, seeking the maximum possible physiological range, to stimulate the isometric contraction of the scapular and pelvic girdle muscles when performing concentric and eccentric contractions of the distal segments as performed by patient to activate disused muscle fibers and improve trunk and waist mobility. Tiredness and myalgia after physical therapy or physical activity or on the following day indicate that the procedures were excessive, and the number of exercises and the number of repetitions should be reduced [14].

5.0 Results

Ten individuals, all males with a mean age of 27.9 ± 9, weighing 70.4 ± 9 heights of 1.65cm ± 4, were evaluated. The evaluation was made by two scales: The Functional Independence Measure (MIF) and the Fulg Meyer Upper Limb Function Rating scale. Table 1 below presents the numerical results of the Functional Independence Measurement (FIM) scale evaluation and the Fulg Meyer Upper Function Rank scale. The results found in the table were analyzed by the Graph Pad Software and applied the paired test with a 95% confidence interval. In the MIF result, p = 0.0067 was obtained, and the increase in functional independence was considered statistically significant. For Fulg-Meyer, the value was p = 0.0011, also presenting a positive and statistically significant increase in upper limb function.

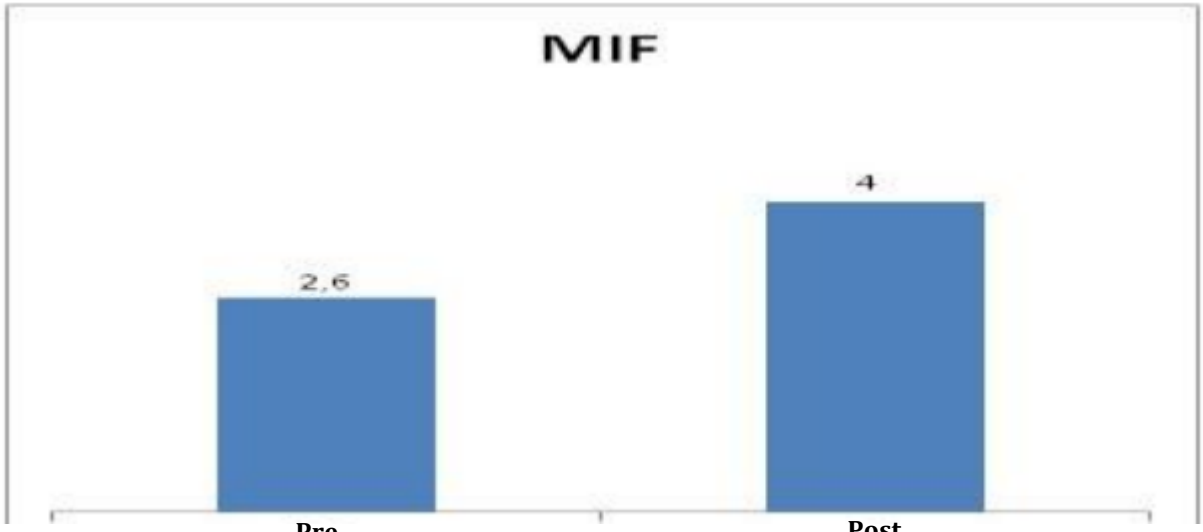
Table 1: Scales applied in Pre and Post intervention

Scales	Pre	Post
MIF	p<0,05	p=0,0067
EMF	p<0,05	P=0,0011

Source: Author

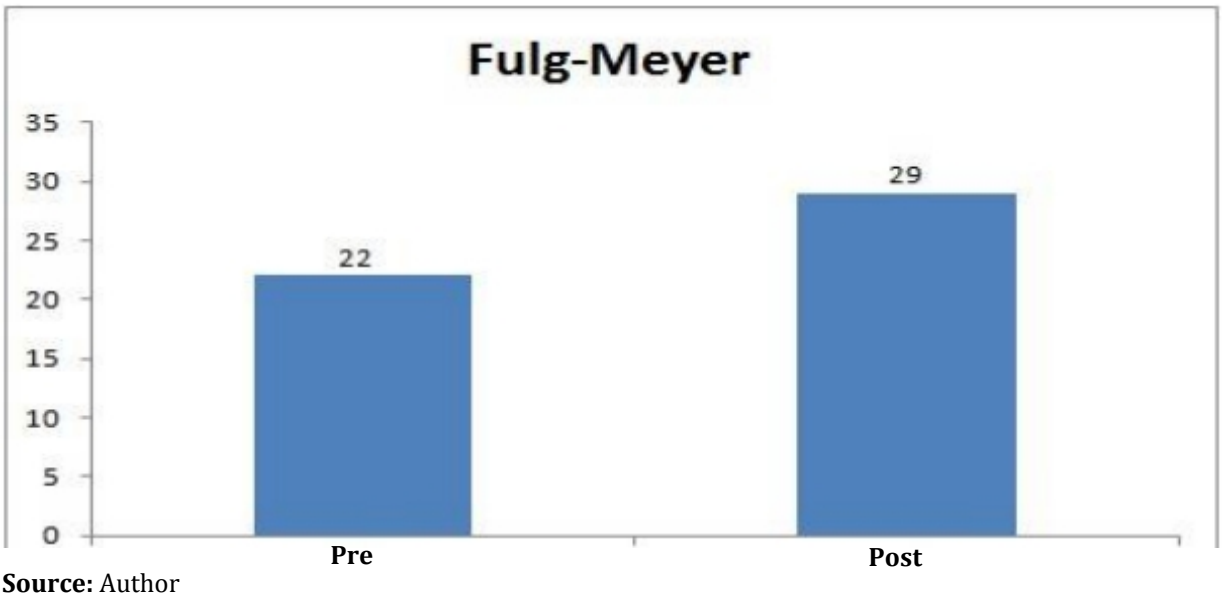
MIF: Measure of Independence Functional
EFM: Fugl-Meyer scale.

Figure 1 and 2 below represent the results of the two scales, where they obtained significant results, with p <0.05, and the MIF presented a mean of 2.60 ± 0.7 and a value of 4 ± 1.2. In the Fulg Meyer scale the result of the mean was 22.5 ± 4.2 and after the intervention with Kinect presented a score of 29.2 ± 5.1. As also mentioned above the graphs present positive and statistically significant results in increasing the functionality of the upper limb.



Source: Author

Figure 1: MIF Scales: Functional Independence Measure applied in Pre and Post Intervention



Source: Author

Figure 2: EFM Scales: Fugl-Meyer Scale applied in Pre and Post Intervention

In a general analysis of the study, even if this increase was not statistically significant, the study considers a positive evolution of this rehabilitation tool, as it is a progressive and irreversible disease, the maintenance of the motor frame presents an excellent evolution, due to this loss of movement was permanent, and the study provided stability of the motor frame by increasing the functionality of the preserved upper limbs.

6.0 Discussion

Based on the studies of SOUZA, (2010) and FERNANDES, (2014) as well as in this work of conclusion of course it was evidenced that the use of virtual reality improves the functional quality and physiotherapeutic rehabilitation, establishing the interaction between patient and the game, contributing to patient motivation regarding treatment. In this study, we noticed that Kinect provides a greater degree of physical activity, as related to the old videogames, as a comparative example we have the Nintendo Wii, Kinect showed better efficiency in the study, because the Nintendo Wii uses the Wii remote manual control), which captures the movements performed by the user when moving it, by means of three built-in accelerometers and an infrared camera, besides the vibration system and a small speaker that emits sounds simpler and near to measure the movements of the hand in three dimensions [15].

And, while Kinect is a virtual reality technology that has a hardware sensor that offers several features to aid in the process of recognition of gestures and voice, the main ones are: infrared light emitter, RGB sensor, infrared sensor, motorized axis and a set of microphones arranged along the sensor. Believing that Kinect does not only improve the functional quality of patients with Muscular Dystrophy, but also provides improvement in the social and affective field.

The interaction of the patient with the game, with other users with whom the patient plays simultaneously, and with the therapist who accompanies him is notorious.

7.0 Conclusion

The use of KINECT in patients with Muscular Dystrophy resulted in a positive evolution of this rehabilitation tool, as it is a progressive and irreversible disease, the maintenance of the motor frame presents an excellent evolution, due to this loss of the movements being permanent, and the study provided the stability of the motor frame by increasing the functionality of the preserved upper limbs. Thus, through this study, we consider that KINECT presents positive and significant results for the performance of function in the upper limbs evaluated by the MIF and Fulg-Meyer functional scales. By facilitating the implementation of this rehabilitation tool, it can be a technique applied at home followed previously by guidelines of the responsible physiotherapist.

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