TEST Engineering & Management

May-June2020
ISSN: 0193-4120Page No. 24489 – 24493

Evaluation of Brain Activity, in Dental Care, in Children, Through the use of Brain Computer Interface and Virtual Reality

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Article Info
Volume 83
Page Number: 24489 – 24493
Publication Issue:
May - June 2020

Abstract

Information and communications technologies have allowed the development of many technologies that are having a strong impact on all activities and professions, the health area is no stranger to these changes. In the present work the evaluation of two techniques of much use is carried out. First the use of virtual reality technology. Second, the use of the brain computer interface (BCI). Both techniques are used in dental treatment in children. In a conventional dental treatment, children have many problems in dental care, with fear of the procedures, which in many cases causes the treatment to be traumatic and in most cases the treatments are not concluded. This paper presents a technique that can help dental professionals, in the treatment of children, with the help of Virtual Reality, making children abstract, eliminating the environment where they are, and placing it in the video scene, which is being projected on the lenses. To evaluate the levels of attention and meditation, at the time of interaction with the Virtual Reality video and dental treatment; A device known as the brain computer interface is used, analyzing the child's behavior. The results show that children exhibit a behavior based on attention, with high levels, when they are interacting with the video at the time of medical treatment, as well as high levels of meditation when preparing for treatment, with these results being manages to verify that children eliminate all kinds of fear or trauma that they may have in dental offices, improving the predisposition of children in dental treatment.

Keywords:*Dentistry, Virtual Reality, BCI, Meditation, Attention.*

Article History
Article Received*: 11 May 2020*
Revised*: 19 May 2020*
Accepted*: 29 May 2020*
Publication*: 12 June 2020*

I. Introduction

In the development of new techniques for the management of patients, with a degree of difficulty such as patients with motor difficulties, elderly patients as well as minor patients. These techniques are based on the use of new technologies such as Virtual Reality and the use of the Brain Computer Interface (BCI). Individual and overall use is changing the way in which these critical patients are treated. We have jobs where they use these two technologies in the management of patients with limited mobility, performing exercises on a bicycle, the use of these two technologies cause the patient to eliminate all types of elements that cause a distraction to the patient, as well as measuring the levels of attention and meditation at the time the exercises are performed to recover mobility, helping to optimize the time dedicated to rehabilitation [1].

The therapy exercises to recover the mobility of the knee, are the most painful exercises that can be experienced, that is why patients attend therapies with fear of pain that will be experienced at the time of the exercises. With the use of the brain computer interface the moments were evaluated where the patient experiences pain and is related to a high level of attention, so the patient is attentive to the exercises and is aware of everything that happens in the therapy. Performing meditation exercises eliminates all types of stress to the patient, improving the perception of pain at the time of performing the exercises [2].

In the recovery of limb mobility, motor imagery is a technique that allows the brain to be trained on the natural movements of the limbs and learning again how the sequence of movements and distribution of the limbs is, as well as its For both the right and the left side, the results of this technique together with the use of the brain computer interface, through the analysis of attention and meditation levels, improve the results in the process of recovery of mobility because. The exercises are performed when the patient is concentrated and measuring the results when he is meditating [3].

The use of the brain computer interface, is being used in many areas, we find jobs when it is necessary to analyze how the behavior of the brain is, when academic activities are being carried out and when video games are being played, to assess when children have greater attention where they can take advantage of these times to improve academic performance, together with game techniques, which optimizes the attention time for the benefit of children.

II. METHODOLOGY AND DATA

The proposed methodology is based on the use of Virtual Reality, with the help of VR lenses and the use of the Computer Brain Interface, through the analysis of attention and meditation levels. For which the study is developed taking into consideration the pediatric patients who are treated in dental centers. In these centers a problem arises where children are afraid of the dentist. Through its teeth cleaning and healing procedures.

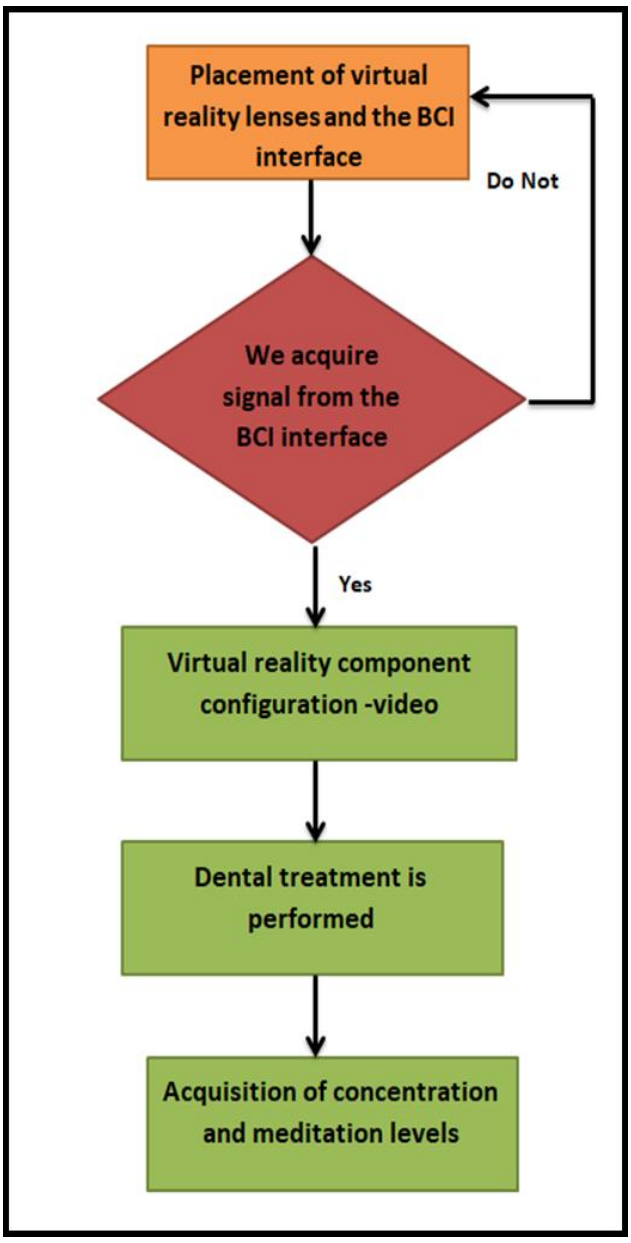

Fig 1: Block diagram of the proposal

In Figure 1, you can see the methodology of the proposal, which consists of the use of both technological techniques, in order to evaluate the technique used, the Brain Computer Interface is required to be located in the patient as well as the RV lenses.

With the configured equipment, the video is projected through VR lenses, where through the video that the patient likes, the child can be distracted and thus eliminate all kinds of mechanisms that cause fear of the child.

Fig 2: Positioning VR lenses in the patient

When the child is paying attention to the video projected on the RV lenses, he is totally distracted and focused on the video of his choice. The patient is ready to be able to undergo routine dental procedures.

At the time the dental procedures are being performed, and the patient is concentrated with the video, the levels of attention and meditation are evaluated through the Computer Brain Interface. The evaluation is carried out at several moments of the dental procedure.

The levels that were recorded are detailed in the results, explaining the level measured and its corresponding action with the dentist.

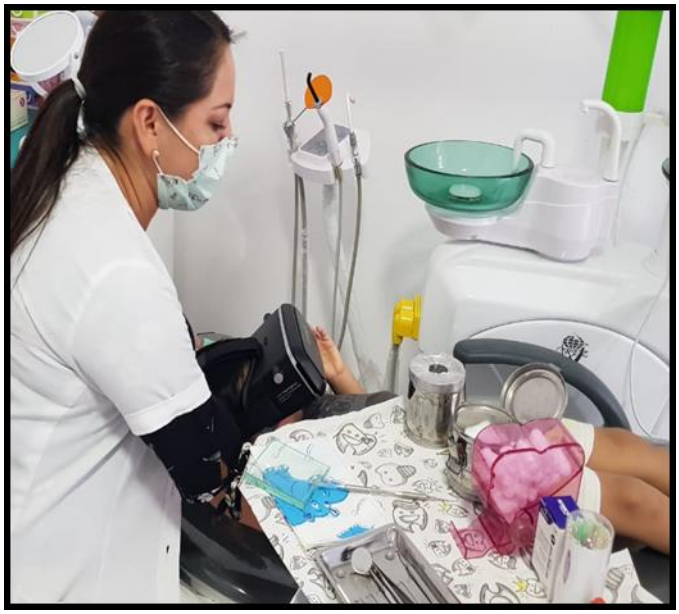

Fig 3: Dental procedure performed on the patient.

In figure 3 the patient is presented, undergoing the dental procedure, the patient is fully concentrated in the game, and the dentist perceives a better response from the patient, since he does not present fear of the procedure, but is submerged in the video. As the video is projected on VR lenses, the elimination of all foreign elements also occurs, which causes the child to only watch the video and no dental instruments.

The values provided by the Computer Brain Interface, is based on the levels of attention and meditation, which is calculated through an analysis of the brain's signals, the device performs the signal analysis and calculates the levels of attention and meditation.

The level of attention is presented when the person is attentive towards an action, being at all times attentive to the changes that may occur, so that he can react as quickly as possible.

The level of meditation is presented when the person is distracted, performing a daily action where it does not require much attention, some change in the action he is performing, the response will be slow.

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These levels of attention and meditation will allow us to evaluate in each of the actions performed by the patient. The degree of cerebral response to each action performed.

III. RESULTS

The results obtained are based on the levels of attention and meditation recorded with the Brain Computer Interface based on the neurosky team [5]. Where the values are presented according to the procedures performed by the dentist, as well as the interaction of the patient with the RV lenses.

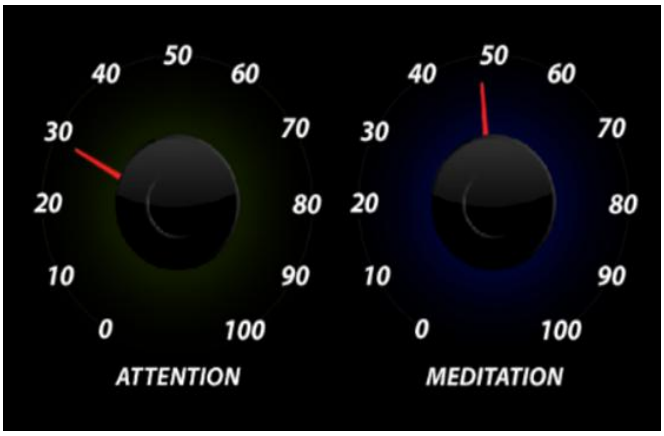

Fig4: Levels of attention and meditation, when the patient is waiting

In figure 4, the response of the levels of attention and meditation is presented, when the patient is in the waiting room, the action he is taking does not present any action to be performed

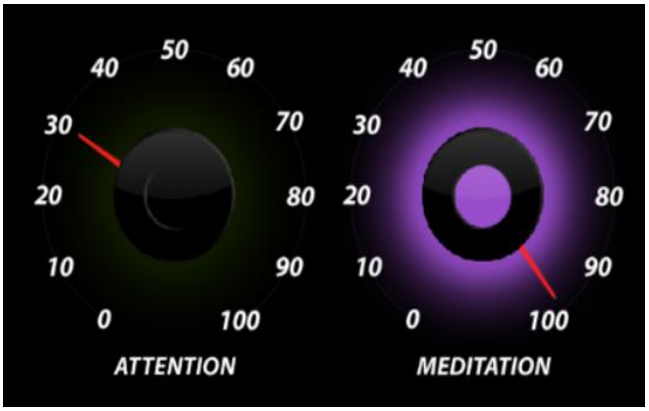

Fig 5: Levels of attention and meditation, when the patient is wearing VR glasses.

In figure 5, the levels of attention and meditation are presented, when the patient is wearing the RV lenses. The action that the patient is subjected to is the waiting for the video to be projected, so the level of meditation reaches almost 100%.

Fig 6: Levels of attention and meditation, when the patient begins to watch the video through the RV lenses.

En la figura 6, se presenta los niveles de atención y meditación, cuando el paciente se encuentra colocado los lentes de RV y comienza a ver el video, se aprecia que el nivel de meditación decrece y aumenta el nivel de atención, por la presencia del video, que es del gusto del paciente.

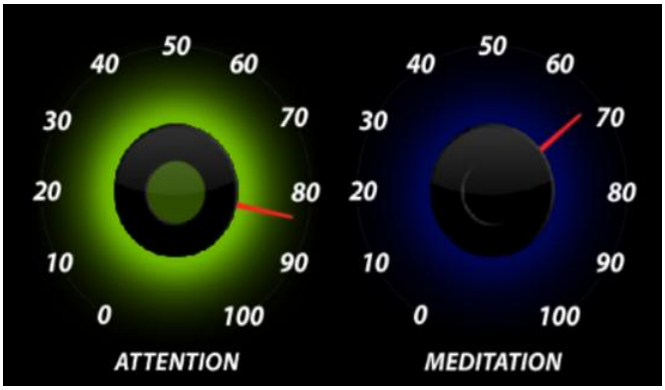

Fig7: Levels of attention and meditation, when the patient is watching the video through VR lenses

In figure 7, the levels of attention and meditation are presented, when the patient is at the peak of attention, it is when he is fully concentrated with

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the video, and it is where the dentist can work, because the patient is paying attention to the video and not to the process that the dentist will perform.

IV. CONCLUSIONS

The conclusions that are reached at the end of the investigation, is centered in being able to find mechanisms that can favor the treatment of pediatric patients. Because patients have to go to the dentist periodically. This constant visit, causes that patients do not want to attend, for fear of medical instruments.

The use of information and communications technologies, such as the use of Virtual Reality lenses, help patients eliminate all types of contact with medical instruments and the procedures to be performed by the dentist, through the projection of videos that patients like best.

To be able to identify if the patient is concentrated with the video that is being projected by the RV lenses, a Computer Brain Interface is used, with which the levels of attention and meditation are measured, to see that both the patient is concentrated with the video and be able to perform the planned procedures.

These available technologies help to perform medical procedures, which are mostly difficult patients like children, older adults. The use of technology is changing as the way to face certain problems, its use must be accompanied by mechanisms where the patient feels more comfortable, trying to eliminate all kinds of elements that cause fear or fear of the patient. Use in different medical disciplines can improve medical interaction with the patient.

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