ERGONOMIC ANALYSIS IN THE AREA OF PHYSICAL THERAPY

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Resumen: Este documento presenta el estudio ergonómico del área de terapia física que se encuentra en un hospital de Ciudad Juárez. Esta investigación analiza el área de trabajo y los trabajadores en la aplicación de la terapia de masajes. El formato del mapa del cuerpo de Marley y Kumar (1996) fue realizado por 7 trabajadores para evaluar los niveles de dolor o malestar y el método REBA (Hignett y Mc Atamney 2000) se utilizó para la evaluación ergonómica. Se identificaron problemas en espalda media, espalda baja, tobillos, hombros y dolor en los brazos. Según los resultados de la evaluación con REBA se observa que en esta tarea hay un nivel de riesgo medio por lo que se presentan recomendaciones para cambios en los componentes del equipo. También se encuentro que estos modelos ayudarían a identificar y evaluar los aspectos ergonómicos relacionados con terapia física y son recomendables para salvaguardar la salud de los trabajadores y para proporcionar los mejores servicios a los pacientes.

Palabras Clave: Fisioterapia, Área de Trabajo, Masaje, Incomodidad, evaluación.

Abstract: This paper presents the ergonomic study of the area of Physical therapy that is located at a hospital in Ciudad Juarez. This investigation analyzed the work area and workers in the task of the massage therapy implementation. The Marley and Kumar (1996) Body Map format among 7 workers was conducted for pain in discomfort study and Hignett and Mc Atamney (2000) REBA method was used for ergonomic evaluation. Middle back, low back, ankles, shoulders and arm pain were identified. The evaluation results indicated that in this task there is a medium risk level according to REBA. Recommendations for changes in the equipment components are presented. It is also found that models that would help identify and evaluate ergonomic aspects related to Physical therapy are recommendable to safeguard the health of the workers and to provide the best services to the patients.

Keywords: Physiotherapy, Work Area, Massage, Discomfort, Evaluation.

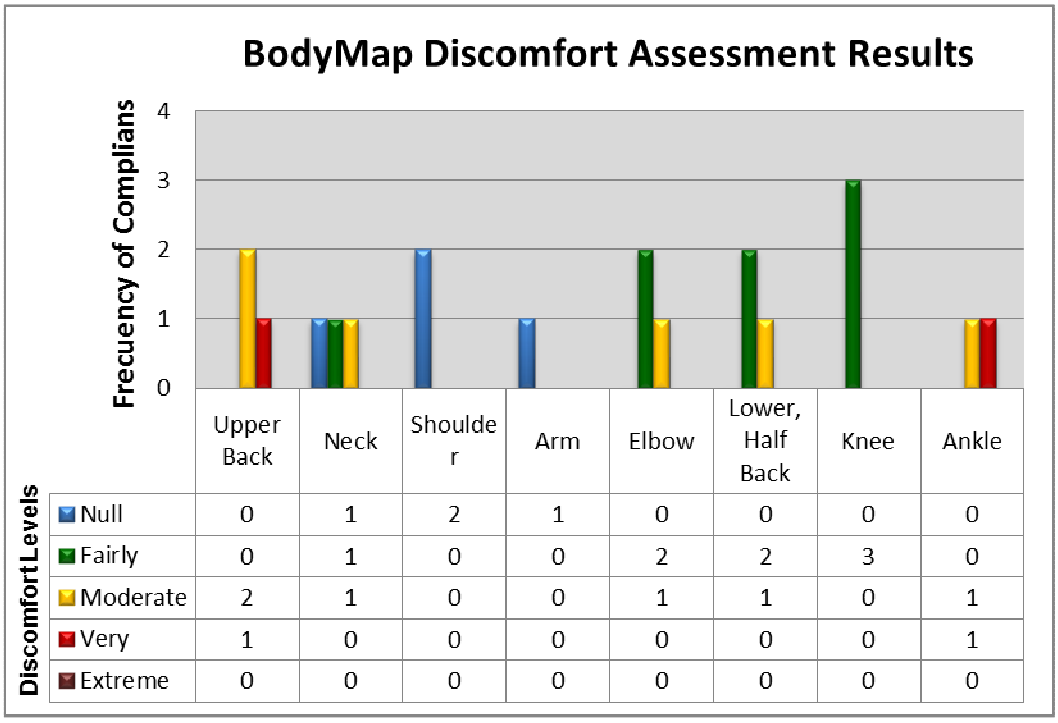
1. INTRODUCTION

This project considered the area of work and workers engaged the physiotherapies patients in a hospital located in Ciudad Juárez, Chihuahua. This study focused on a proposal for the improvement of the working area and the tasks that develop physiotherapists in search of greater efficiency, comfort and security**.**

1.1 Problem Description

This study took into consideration the massage therapy and its working area. This consideration was a consequence of the application of the Marley and Kumar (1996) Body Format among 7 physiatrists; the massage therapy had resulted as the more stressful activity for the physical therapists.

In addition, complains and discomfort's levels of the different therapist's body parts are shown in Figure 1.



Discomfort Levels	Upper Back	Neck	Shoulder	Arm	Elbow	Lower, Half Back	Knee	Ankle
Null	0	1	2	1	0	0	0	0
Fairly	0	1	0	0	2	2	3	0
Moderate	2	1	0	0	1	1	0	1
Very	1	0	0	0	0	0	0	1
Extreme	0	0	0	0	0	0	0	0

Figure 1. BodyMap Discomfort Assessment Results

As it is noted, the indicator of discomfort level classified as "Very" is found only on the upper back and ankles; also evidence of the discomfort level "Moderate" is mostly found on the upper back, neck, elbow, lower and half back, and ankles. Likewise the manifestation of

the discomfort level named as “Fairly” was generally originated on the elbows, knees, and lower and half back.

Consequently, the presence of theses complains of pain among the physical therapists is evidenced when the therapists applied the massage therapy. Moreover, stressful body postures and repetitive movements of hands and arms were identified. Therefore, an ergonomic assessment in this situation is proposed.

1.1.1 Objectives

This project presents an overall objective and five individuals, which are explained below.

1.1.1.1 General Objective

Apply ergonomic and anthropometric principles to the design of the work area and the postural evaluation of the worker, in this case the physical therapist.

1.1.1.2 Specific Objectives

1. Establish the area and the different tasks to study.
2. Use methodologies accepted in the literature to assess the positions of the worker.
3. Assess the degree of discomfort experienced in performing the tasks by means of the questionnaire of Marley and Kumar (1996).
4. Propose improvements and/or changes in the design of the working area and working methods.
5. Propose changes or redesigns of the devices and tools.

1.1.2 Justification and Scope

The potential benefits to get with this project are:

- A greater efficiency in the working area by promoting a better manipulation of instruments, facilities and techniques.
- The prevention of injuries among physiotherapists by improving the positions taken during their work.
- Provide a better service to patients.
- Learn different risks which the physiotherapists are exposed.
- Optimizing and saving space where these tasks are performed.

The results obtained by this project can be applied to the area of physiotherapy, to analyzed tasks and the problems identified.

2. LITERATURE REVIEW

To address the problem, theoretical evidence for ergonomic problems are presented, where various studies indicate that cervicalgias, backche, low back pain and muscle aches are common within this group and have been associated to stressful postures, manual handling

of heavy loads, inclinations in carrying out tasks and poor facilities (Briseño, 2005). Some conclusions from these studies are shown.

Bork and collaborators (Bork, 1996) have found that most common musculoskeletal disorders among physiotherapists are found in back, wrists and hands. The factor that causes most likely occupational hazard of these ailments is lifting and/or the transfer of patients. This study found that injuries more frequent and in order of importance were: low back and neck, Middle back, shoulders, hands, knees, feet, hips and elbows.

On the other hand, Hildebrandt (Hildebrandt, 1997) found that the position, strength and movement are the risk factors for the appearance of musculoskeletal pain in the lower part of the back in these same workers.

In addition, Viikari and partners (Viikari, 1996) have statistically demonstrated a correlation between the strength and the posture with back pain. This study was conducted with practitioners of physical therapy which in a working day they care an average of 3 patients per hour, and where their activity forced them to perform repetitive motions and sometimes carrying weight. Likewise, some rehabilitation techniques that are applied to patients require that the physical therapist bends over repeatedly doing large loads of weight. Kumar (Kumar, 2001), States that these activities, postures, movements and repetitions are biomechanical risk factors causing damage to the tissues, resulting in recurring pain that eventually results in musculoskeletal injuries.

According to the use of these studies and history, this project will expand the information with the application of ergonomic principles, methodologies of evaluation and the application of questionnaires to physiotherapists to identify and study the problems that they suffer during their work.

3. METHODOLOGY

Methods and materials used in this study are presented in this section; first a description of the materials used and then the applied methodology.

A digital camera was used to take video and pictures of the physiotherapist as he performed the massage therapy with the purpose of identify possible stressful positions. On the other hand, a measurement tape was used to measure the physiotherapist's dimensions and finally a laptop computer to run the REBA's software.

3.1 Definition of the Relevant Human Body Dimensions

The measurement tape was used for the measure of the different dimensions of the therapists towards determine and analyze those human body dimensions which are relevant, define the best anthropometric principles, and the percentiles suitable for our study.

3.2 Registration on Videotape and Photographs of the Physiotherapist's Activities

A digital camera was used to observe and record the massage therapy given by the physiotherapist to a patient. These video and photographs both were taken in the angle that

is require by the REBA's software in order to make an objective study; also the video helped to evaluate the different positions that the physiotherapist adopts and the duration of them while the therapy is in progress.

3.3 Description of the Task

Work task consist in the application of the massage through the hands of the physical therapist to the patient. This is done with the patient lying on a table especially designed for this task. On the other hand, the massage cannot last more than 10 minutes otherwise it reduces its effectiveness.

The physical therapist moves around the table to perform the massage in different parts of the patient's body by applying pressure, tension, motion, or vibration.

There are different types of massages that the therapists can execute. Some applied massages are:

- Medical massage: Combination of manual technical movements and maneuvers that are made in a harmonious and methodical way with therapeutic purposes; this massage is applied with the hands and allows assessing the status of the treated tissues.
- Deep tissue massage: This type of massage focuses on the muscles located below the surface of the top muscles. Deep tissue massage is often recommended for individuals who experience consistent pain, are involved in heavy physical activity (such as athletes), and patients who have sustained physical injury.
- Myofascial release massage: Myofascial release refers to the manual massage technique for stretching the fascia and releasing bonds between fascia, integument, and muscles with the goal of eliminating pain, increasing range of motion and equilibrioception. Myofascial release usually involves applying shear compression or tension in various directions, or by skin rolling.

3.3 Description of the Working Area

The working area is located in gymnasium from the department of physical therapy. It consists of two massage tables.

3.4 Application of the REBA Method

Pictures and both sides' results of REBA for the most critical operations in massage therapy are exposed underneath.

Figure 2. Physiotherapist.

Figure 3. Physiotherapist's left side close up.

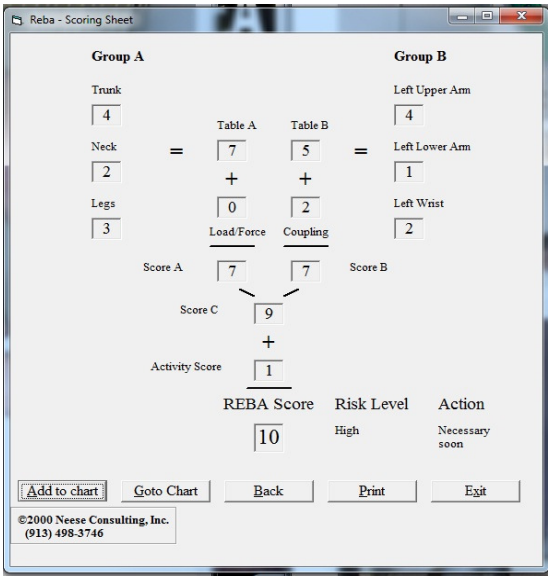


Figure 4. Scores of REBA (left side).

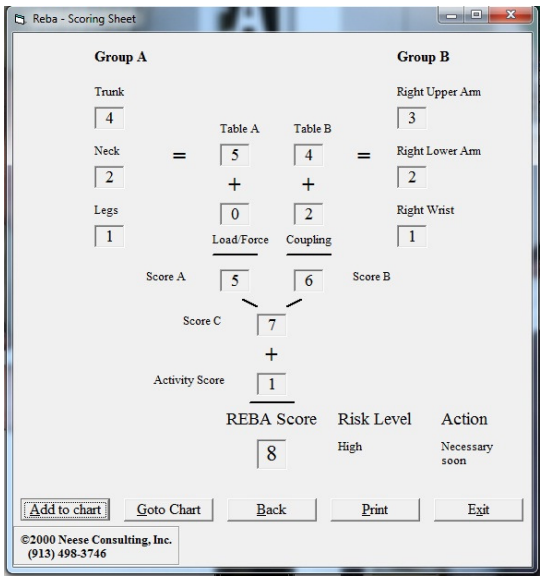


Figure 5. Scores of REBA (right side).

4. RESULTS

This section presents the results achieved in this assessment.

4.1 Anthropometric Results: Relevant Human Body Dimensions, Anthropometric Principles, and Suitable Percentiles

As a result of the analysis of the mentioned activity, the relevant measurements of the massage table for this study are:

1. Height: 67 centimeters
2. Width: 60 centimeters
3. Length: 200 centimeters

According with the table's height measurement, difficulties for tall persons are observed due to the constant bending of the torso that result in back and neck discomfort.

On the other hand, body dimensions, suitable percentiles and anthropometric principles were identified for each relevant dimension of the massage table. The results are presented in the following tables.

1. Height: 67 centimeters

Body Dimensions	**Anthropometric Principles**	**Percentiles**
Stature	Design for Extreme Individuals. Design for Adjustable Range.	95
Elbow Height	Design for Extreme Individuals. Design for Adjustable Range.	95

Table 1. Body dimensions, suitable percentiles and anthropometric principles for the table's height.

1. Width: 60 centimeters

Body Dimensions	**Anthropometric Principles**	**Percentiles**
Forward Functional Reach with Body Depth at shoulder	Design for Extreme Individuals.	5

Table 2. Body dimensions, suitable percentiles and anthropometric principles for the table's width.

4.2 REBA Results

The REBA score sheets presented a High risk level for both sides; this means that an ergonomic intervention is required as soon as possible.

According with REBA scoring sheet, the trunk is extremely affected and it has a score of 4 since the physical therapist has to bend repetitively in order to perform the therapy; this produce mechanical stress.

Likewise, the left upper arm has a score of 4 due to the massage table's height and an ergonomic assessment and redesign is necessary.

5. CONCLUSIONS AND RECOMMENDATIONS

This section concludes about the results obtained, and contrast the goals outlined in this work.

This ergonomic analysis was performed in those body dimensions which are relevant to the execution of the task. Moreover, the application of ergonomic principles was essential to determine if the work areas, machinery or tools were correctly adapted to the worker. In this case, REBA method was effective in the identification of high level risks that the physiotherapists are exposed to.

Recommended ergonomic interventions due to the analysis of the work area, the application of the REBA method, and the definition of the relevant body dimensions, suitable percentiles and anthropometric principles are listed underneath.

1. The acquisition of a new massage table with adjustable height in order to enhance the adaptation to the different stature of the physiotherapists and the prevention of injuries.
2. The Purchase of anti-fatigue mats to surround the table in order to reduce fatigue and stress within therapists.

Furthermore, the effective design and redesign of workstations and the application of ergonomic principles would encourage productivity, but mostly help therapists to be comfortable and secure.

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