

A Review of Uses of Ergonomic Tools in Physiotherapy

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Abstract: This paper trying to emphasizes the uses of ergonomic or human factor engineering tools in the field of physiotherapy for the betterment of patient in easiest way. The sole objective of this paper is to review, world most pioneered and most recent developed techniques in physiotherapy by ergonomics engineers. However, in this paper software's tools are also are also discussed in brief. Ergonomics is a multidisciplinary science which comprises of man, machine and factory conditions for the environment for improving efficiency with less fatigue to workers. Physiotherapy is branch of medical science, it is concerned with remediation of impairments, promotion of mobility, functional ability, quality of life and movement potential through examination, evaluation, diagnosis and physical intervention. Now a day's medical science and engineering are going together and developing machines which will help patient for quick and easy recovery.

Keywords: Ergonomics, Physiotherapy, Occupational therapist, Musculoskeletal Disorder etc.

I. Introduction

In today's world, where work load in offices is tremendous and quality of the food is deteriorated day by day; a question of health of every individual becomes very serious issue. Most problematic cases are sitting arrangement provided in offices, office plan layout and walking or sitting posture of every individual, this contributes towards the health related issues and need of occupational therapist or physiotherapist arises. Engineering researchers and medical practitioners had worked together in a multidisciplinary approach and the invention of some tools which required for betterment of health over a few causes are found. It is also found from one survey that the integration of ergonomics and engineering approach while designing new workplaces and production units have resulted in increase productivity and keeping moral high of the employees[1]. A extensive methods of integrating ergonomic knowledge with engineering design is not limited only to for providing the designers with information on ergonomics, but it's to get involved in process till the products gets finalized and results in expected outcome as mentioned in handbooks of ergonomics. However while writing this paper author has come through some paper which describes the approach stated in handbooks doesn't ensures success. In one paper it is also mentioned that one in six make a career change because of musculoskeletal injury. Musculoskeletal injuries are associated with individual handling of human body or any activity requiring lift, push, pull, carry or move, restrain or hold an animate or inanimate object.

II. Literature Review

A. Jean E Cromie,Valma J Robertson and Margaret O Best: As mentioned in this paper 91% of physiotherapists (91%) deals with the patient having musculoskeletal disorders(WMSDs).it is being also revealed in this paper that one in six are force to do career change as a consequence of WMSDs.

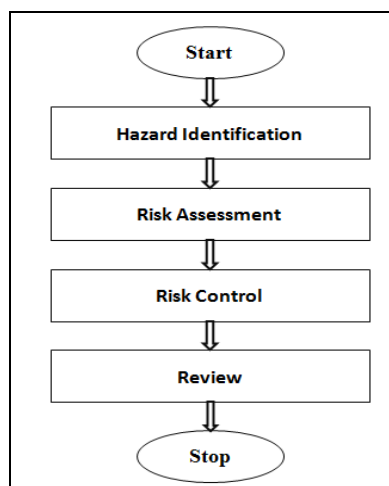


Fig. No.1. Physiotherapists risk management tool

There are total 8 rules to implement these tool discussed in brief as follows,

1. All practicing physiotherapist must get converse with the legal requirements of occupational health and safety. As a minimal they must be aware of risk management tool and its components e.g. hazard identification, risk management, control and review of their workforce and offices.
2. The majority of office workers may experience musculoskeletal disorders, low back, upper back, and neck, upper limbs these parts of the body are most vulnerable to risk of injury and must be taken care.
3. Australian government formed ergonomic guidelines for space, equipment, environmental conditions and office furniture and it has made mandatory while designing an offices and production units.
4. All office staff and workers job must be designed to ensure variety in the physical demands of work this may include, rest breaks, scheduling of different activities throughout the day, physiotherapy sessions and occupational therapy sessions.
5. Uses of different ergonomic tools must be increased for reducing musculoskeletal disorders.
6. Training to all office staff is must be done every year for using ergonomic tools and practicing occupational therapy in the working environment.
7. Risk assessment is very important tools for controlling musculoskeletal disorders, once it is implemented must be monitored and alteration must be carried for betterment of working conditions. Review of the musculoskeletal disorders must be carried out by an individual or by the institute in specific period of time.
8. Prospective office workers/ labors must need to understand the physical demands and constraints of the job well before the joining any industry or the institution.

B. Murat Dalkilic, Gonca Bumin & Hülya Kayihan: In this paper author has carried out the study for the investigation of the effects of ergonomic training and preventive physiotherapy program in visual display terminal operation engineers having musculoskeletal pain. This study was carried out in IT firm in turkey and total 40 operation engineers were considered, consisting of 15 female and 25male in the age group of 23-32 years. All the participants in the program was firstly evaluated by the tool called national institute of occupation safety and health checklist tools for investigation of exposure of workers in risk factors associated with upper limb problems caused by working posture or atmosphere and all this factors were analyzed by using two tools, VAS (Visual analog scale) and RULA (Rapid upper limb assessment. All the participants in the program are trained with two session of six hours each after one week of initial assessment and after training all VAS and RULA are applied again. It has been found that before training and post training ($p < 0.05$), p is the significant of correlation between pain and RULA. Based on this figure author has concluded uses of ergonomic tools and physiotherapy programs were effecting in IT firms and it will reduce postural risk factors also it will help in reducing work related environmental and ergonomic risk factors.

C. S Ruzsala, I Musa: In this study author has identified as a major cause of back or neck pain. In this paper author aimed at whether we can develop any equipment, to assist sitting and standing activities. Four types of tools or equipments were evaluated in randomized balanced presentation order. Study had been carried out to limited number of group of people. Major outcomes from this are on the basis of perceived rate of exertion, ease of use, effectiveness, stability and posture and duration of the task. After this study author concluded that not to adopt chair lifter or the walking harness as it possesses risk of injury. However after completion of this study practicing physiotherapist suggested that equipment should have variable speed drive option for meeting individual patient's needs.

D. Marsot J, Claudon L: In the late 20th Century it's been found that the number of musculoskeletal injuries are increased in many industrialized countries and more specifically in companies require the continuous uses of hand tools.



Fig. No.2. Boning Knife

In 1999 French government formed a National Research and safety institute(INRS) , particularly keeping the aim of integrating ergonomics into hand tool design particularly designing of boning knife for reducing workers fatigue. After a brief research and integrating ergonomics, the uses of three design tools; functional analysis, quality function deployment and TRIZ have been applied while designing object. And researchers have found most suitable model for boning knife, also they understood the difficulty of integrating ergonomics in designing tool.

E. Lene Bjerg, Hall-Andersen, Ole Broberg: The main purpose of this study is to explore the role of different kinds of objects while integrating ergonomics in engineering design process. In this paper different objects were analyzed using two different concepts: boundary objects and intermediary objects. The uses of boundary objects facilitates the collaboration between different domains of the knowledge. At the same time intermediary objects was used for the circulation of knowledge and thus it increases the distinct effect. It's been observed by the author that, adjustable layout and drawings served as a boundary objects and it also provided positive impact in the conversation between ergonomist and designers. However following all the aspects were not possible while incorporating this paper ideas, as it may affect the productivity, but few are implemented in practice and it resulted in better ergonomic working environment. Author concluded that, while planning or ergonomic workplace is to be carried out, ergonomists and engineers shall discuss and map various things required for making workplace more ergonomic and workers working in the production units must not visit occupational therapist or physiotherapist. Author also commented on boundary object and intermediate object tool. Boundary object tools are well expected or can be executed 'on the spot' as this will give visualization of different design possibilities and it creates positive environment for talk between ergonomist and engineering designers. Intermediary object tools allows ergonomist and engineering designers to look ahead in planning and needs to consider obstacles ahead while implementing and take remedial action jointly.

F. Jonathan DeShaw and Salam Rahmatalla: From all of our experience, we all aware of prolonged sitting may lead low back pain and many times it is resulted in the disturbed shape of the spine. Sometime it is found that this problem becomes worse where whole body is subjected to vibrating environment. The use of lumbar support is quite common in office environment, particular IT offices where very prolonged sitting is required. But the fact that there are very less facts known about lumbar support. In this paper different lumbar supports are made and it is also being compared with commercially available lumbar supports and results are compared. In the fig. no.3. three different lumbar support used in original paper shown as it is.

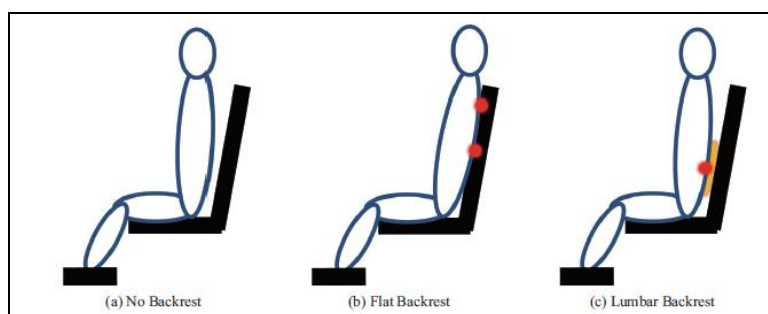


Fig. No.3. Three seating configurations used in study: (a) no backrest support, (b) flat backrest support, (c) lumbar backrest support. Dots indicate backrest contact points, and light-colored ovals represent the lumbar support location.



Fig. No.4. The lumbar backrest support condition used three commercially available lumbar support types: (a) black cushion, convex type, soft foam support LS1, (b) tan cushion, concave type, hard foam, support LS2, and (c) blue cushion, concave type, soft foam, support LS3.

It's been concluded by the author, all lumbar supports used while carrying out this studies have shown that it reduces the head motion and reduced discomfort and effectively reduced whole body vibration. Moreover, the lumbar supports are more comfortable for lower head motion and lower discomfort as compared with flat backrest. Also the ergonomic design of lumbar support helps in maintaining the natural shape of the lumbar spine during operations and would help operators to carry out daily work in a pleasant way.

III. Software Based Evaluation Tools

All software's listed here based on computer, all the checklist items mentioned in various legislation are taken care of while designing this software. This software also comes loaded in handheld type PDA device.

1. ErgoIntelligence and Ergomaster – This software is very handy and comes with few modules containing broad range of features. The software developed is easy to use and it produces reports very easily. Ergomaster is designed in a such a way that there will be an minimal knowledge of computer. In this software, we can customize reports according to need of medical practitioner. While using Ergomaster, users are allowed to receive the images from internet as well as from the popular packages.

2. ERGOMIX – Is one of the best software, where we can integrate the images of real operation in CAD plots for evaluating workstation layout.

3. ERGOWATCH – This is computerized tool used for ergonomic measurement and analysis system. This system consider of four different ergonomic measurement techniques designed for estimating and interpreting the physical loading related with the job. Tools in ergowatch are 4D WATBACK, NIOSH Tool, SNOOK Tool, Physical Demand Description(PDD). The cost of this computer is around 600USD.

4. FIT – This technique is loaded in personal digital assistant(PDA) based tool for the observation of work tasks.

5. HARBO – This is very simple and easy to use equipment and used for recording work postures as reported by Wiktorin et al., 1995. This works on the principle of multimedia video task analysis tool and analyses the video sequences in terms of task performance and postures. It is being developed by university of Wisconsin-Maddison.

6. NIOSH lifting equation – This tool is used for calculation of maximal permissible lifting load and this tool is being used in Ergowatch software.

7. The Observer XT – This is another video analysis tool mostly suitable for task analysis and usability evaluation. This comes loaded with PDA device and allows integration of results obtained from PDA and biophysical signals like force, EMG etc.

8. PEO – Portable Ergonomics Observation method for computer supported field observation, developed in Sweden (Fransson-Hall et al. 1995).

9. Posture Program – Posture program is very easy to use video based approach, allows quantification of major parts of the body e.g. trunk and arm postures and velocities during work as stated in Neumann et al., 2001.

10. VIDAR/PSIDAR – In this approach physical (VIDAR) and psychosocial (PSIDAR) both approaches have been considered in the working environment.

IV. Conclusion

Ergonomics is very important thing and need of every human on earth for better living. Most of software company workers are in sitting position for a longer time they must take help of occupational therapists or physiotherapist and in consultation with ergonomic engineer they can design lumbar support, according to individual needs. In this paper author tried to review most pioneered paper in ergonomic tools practiced worldwide. Author has also made a sincere attempt to revisit the entire software list and brief them in this paper.

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