

Integration of Ergonomics in Continuous Passive Motion Machine

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Abstract: The paper is about importance of ergonomics, in development of devices such as continuous passive motion machine. Also its effect on joint mobilization is discussed. Today the ergonomics science has broadened to every day's task right from spoon, hand tools, knife, chairs etc. Ergonomics is applied from industrial machine to daily work. It is the faith in ergonomics that has totally changed the design scenario. Continuous passive motion (CPM) therapy is normally use as first stage exercise in the postoperative treatment of joints in the first post orthopaedic surgery. After surgery passive range of motion helps to prevent joint stiffness, Deep-vein thrombosis (DVT), edema, soft tissue contractures, muscle fiber atrophy, contractures, and osteoporosis. It is important, however, to begin physical exercising of the knee immediately to restore strength and full range of motion after postoperative treatment by CPM.

Keywords: Ergonomics, Physiotherapy, Continuous passive motion, Knee Joint.

I. INTRODUCTION

Ergonomics is a science which is combination of many branches like engineering, human anatomy and social sciences etc. the objective is to improve the interaction between human and machine, what we talk about 'fit for purpose'. Now a day's ergonomics is applied to the product design, aviation (design of planes) , the vehicle design etc.

It is observed that post orthopaedic surgery most of doctors preferred physiotherapy for patient for fast and better recovery. Physiotherapy is also used to restores joint range of motions (ROM). From survey it is observed that most of physiotherapy equipment are imported and not fit for the Maharashtra population. These papers try to reach the importance of ergonomics in building CPM user friendly.

II. OBJECTIVE OF ERGONOMICS

The scope of ergonomics design means should be designed appropriate for human. The ergonomics is word derived from Greek ergo ie work and noms means by natural law. Ergonomics is sciences of fitting the job to employee and product to user. Approach is to consider not only design but also functional efficiency, ease to use comfort and health. Ergonomics is applied to many human activities from machine operation to daily work. It is fact that ergonomics changed the traditional design process of machine and instruments and the way we use them.

Industrial ergonomics has many significant implications for improving productivity, efficiency while considering the health and safety of individuals. It facilitates a smooth human interaction between human and machine. Ensuring this healthy interaction optimizes employee productivity quality and also insures comfort safety and health.

III.IMPOTENCE OF CPM IN PHYSIOTHERAPY

The aim of physiotherapy is to improve health and physical comfort by maximizing mobility of joint and functional ability. Physiotherapy is concerned with identifying and maximizing quality of life and movement potential within the circle of promotion, prevention, treatment and rehabilitation. It includes physical, social, psychological and emotional comfort.

Therapeutic exercise may be defined as "bodily movement to correct impairment, improve musculoskeletal function or maintain a state of well-being." [1]The treatment principles of stretching and passive motion may be applied to decrease major limitations in ROM. Contractures of soft tissues can be decreased by the implementation of these principles.1 With passive stretching, an external force stretches the contracture at the limited joint. Gentle stretching has been shown to be more effective than vigorous stretching for gaining ROM over a period of time.[1]-[3] Stretching must be performed daily to be effective. Tissue that has been immobilized must be stretched slowly and carefully.[1]-[3]. The harmful effects of immobilization now can be minimized by a new concept involving continuous passive motion (CPM).[10] The usual CPM machine for the lower extremities (hip and knee) is rectangular and small enough to fit in the patient's bed. The device gradually, but continuously, flexes the patient's knee through a preselected arc of passive motion.[5]-[6] Continuous passive motion has been shown to be beneficial in the healing and regeneration of articular cartilage and, subsequently, in the relief of arthritis. [4] Thus far, the CPM machine has been used primarily for 1fractures involving the knee joint, knee reconstruction following athletic injuries and total knee replacement for advanced and painful arthritis of the knee. [7] The continuous passive motion (CPM) device is a treatment modality in which knee joint motion is provided by a

machine without causing active contraction of muscle groups [8]. Generally the modern machine is programmed to passively flex and extend the knee joint through a pre-selected range of motion and rate of repetition.

This post-operative passive range of motion helps prevent joint stiffness, edema, soft tissue contractures and muscle atrophy [9]. Consequently many surgeons utilize CPM following knee articular cartilage surgery as their standard of practice [10]. After treatment with the CPM, physical exercises are consequently needed immediately to restore strength and full range of motion [11].

IV. DIFFICULTIES IN INTEGRATING ERGONOMICS INTO DESIGN

Design has traditionally been seen as a process of creating products that can out functions in accordance with an initial set of specifications or requirements. There are a number of different models of design. Most models of design assume that the design process consists of a relatively small number of stages such as problem formulation, conceptual design, realization design, and evaluation and testing.

Designers need ergonomic information in a form that will help them make decisions. They want to know what is good, what is bad (inadmissible) and what the value of intermediate levels of usability or safety are in terms of the other evaluative criteria (e.g., costs, probability of error) that they work with [12]

Design and development of any product for the rehabilitation program has required knowledge of ergonomics, product optimization with physiotherapy requirement. J. Rasmussen et al. state the optimization is based on a detailed inverse dynamic analysis of the motion and forces of the human body.

The problem of muscle recruitment calculation in inverse dynamics is introduced and solved via a min/max optimality criterion.[13] Introducing methodological tool at design level will enhance the ergonomic property of the product. Quality function deployment is one of tool that can introduce at design stage can improve the quality as well as ergonomics of the product in physiotherapy equipment.

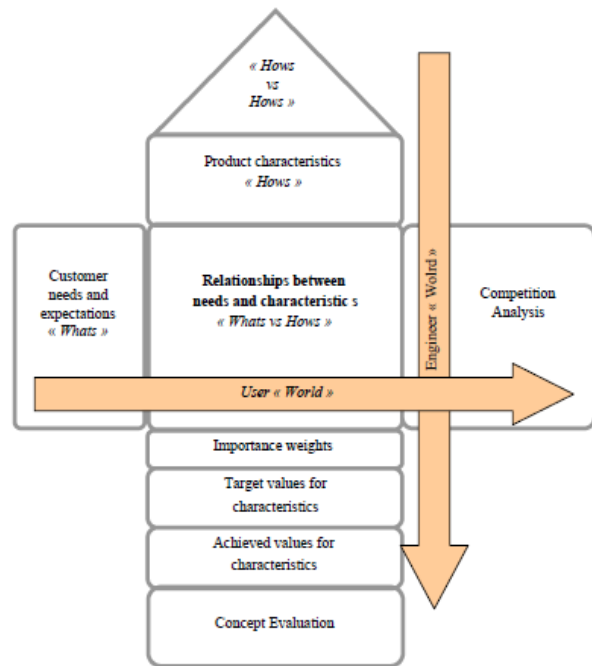
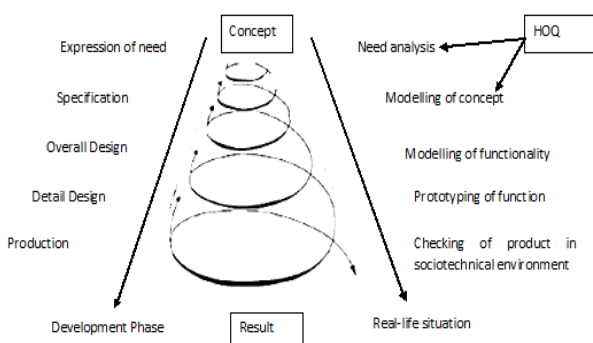


FIG: 1 INTRODUCING ERGONOMICS AT VARIOUS DESIGN STAGES [13]

V. CONCLUSION

The Ergonomics is most essential science in occupational and health safety were the continuous passive motion is one of effective therapy after post orthopedic surgery. In survey it is notice that physiotherapist is not concerned during design of physiotherapy equipments, Now he can take part in selecting design parameters by considering various ergonomics need. One should intervene ergonomics parameters with design parameters. It is necessary to integrate ergonomics tools at various stages of design.

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BIOGRAPHIES



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