

COMPACT STRETCHER WITH SHOCK ABSORBERS: A PROPOSED MODEL

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Abstract: -

Stretcher is an essential part of medical first aid system. Safe and early delivery can save life of a serious patient. Today stretcher is available in different designs. Efforts are taken to make the stretcher more comfortable in ergonomic point of view and more attractive in aesthetic point of view. Use of shock absorber in hand lifting stretcher helps not only to reduce shocks produced due to rough travelling and natural calamities but also reduces chances of bleeding and damage to internal body parts due to shocks or vibrations generated during fast and rough travelling. The paper proposes a model of compact stretcher with shock absorbers and also discusses the way for analysis of the stretcher.

Keywords: - Stretcher, Shock absorber, CAD model.



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INTRODUCTION

Design of stretcher is very important while considering safety of patients. Need of hand lifting stretcher arises while delivery of a patient who has caught in road accident or in a terrorist attack like bomb blasts. During war time stretcher becomes necessary for safely travelling of injured soldiers. Hence it should be designed in such a way that it becomes light in weight so easy to carry. Also patient should feel relaxed and comfortable while travelling. During bomb blasts, road accidents etc. peoples get severely damaged, but many a times fast and timely evacuation can save life of a patient. During war time it becomes essential part of war strategy to save life of soldiers. Also during natural calamities like flood, Tsunami or terrorists attacks like bomb blasts, it becomes necessary to travel the victims to the nearest hospital as early as possible. Hence it requires quick and fast transportation. But it has been seen that, patients get more damaged during his fast evacuation due to shocks generated while rough travelling. Sometimes it may cause death of patient. Hence it becomes necessary to reduce these shocks. Also for quick transportation of stretcher, it should be light in weight and compact in size.

To achieve these two difficulties, it is necessary to design a compact stretcher with some technique of vibration shock reduction. Today a number of designs of stretcher are available in the market with variable cost and sizes. But it has been seen that cost of stretcher also increases along with use of shock absorber. Efforts are taken to use hydraulic shock absorber for hospital road stretchers, but this stretchers cannot be used in war and also on rough roads in villages. Hence it becomes necessary to use shock absorbers in hand lifting stretcher which can be taken anywhere. Helical spring shock absorber can be use for reduction of shocks generated due to rough handling. It is mounted in between handle and the bed. Another end of stretcher is made rigid so that it performs the function of damping. It is designed in such a way that one can make it compact upto one fourth of its original size.

Literature Review

An exhaustive literature review is carried out to understand the present practices in stretcher design. It would help to use shock absorber effectively in a hand lifting stretcher. V. B. Bhandari (2012) has published his latest edition of book "Design of Machine Elements", It consist of design parameters for design of various mechanical components. Different parameters for design of helical spring like free length, pitch etc. and the formulas to calculate them are taken from this book. Also for selection of standard sizes and factor of safety etc., PSG Institute Data book[2] is used. Sudarshan Martande, Y.N.Jangle and N.S.Motgi(2013), has studied on different correlated methods to design components of shock absorber using FEM based tools. FEM tool is used to calculate different stress and deflection values in shock absorber to compare it with analytical solutions. Premchand Gupta, Suresh Garg and Sachin Maheshwari(2012) had published a paper on design of casualty evacuation stretcher using hinge joint. They have studied use of different joints like socket joint, hinge joint, slider joint etc. to make compact design of stretcher which is suitable for Indian army. The stretcher becomes foldable and more compact with use of hinge joints. Vajreshwari Umachagi, KattaVenkatarmana, G. R. Reddy, had studied on use of shock absorber for vibration control of different structures. Shock absorbers can be used for vibration control of stretcher and the methods to implement them. While designing a stretcher, the most important factor to be considered is the safety of patient. Arif Duran, Hayrettin Ozturk, UmitYasar, Muchahit Emet had studied the effect of stretcher type on safety and ease of treatment in an emergency department. A survey of 139 questionnaires from 15th January to 29th February 2012 would decide the requirements of patients from a god stretcher. Ace `wire spring & form company, inc. had published a chart on study of different materials and their properties. After studying different materials given in this chart, hard drawn spring steel material is selected for helical spring.

Proposed Methodology

Shock absorbers can be implementing effectively in design of stretcher for reduction of vibration shocks. Shock absorbers are used only on one side of stretcher where head of patient rests as shown in figure below. Total 4 shock absorbers are required for a stretcher, two of them are connected vertically to compensate vertical degree of freedom and the remaining two are connected in 45degree to compensate horizontal degree of freedom. Side by side movement is not considered since it is negligible. Figure below gives overall idea about implementation of shock absorbers in stretcher design. Other side of stretcher is made rigid so that it can be used for damping. With this mechanism stretcher doesn't remain parallel to ground, it gets lifted by 20cm at one end of shock absorber because free length of helical spring is 20cm. Also the design is foldable and can be make compat upto 1/4th of its normal size.

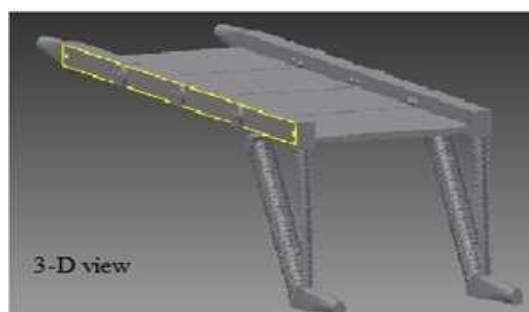


Fig. Initial overview of compact stretcher with use of shock absorber.

Discussion

Different papers discussed above in the literature review helps in designing of compact stretcher. Prem Chand Gupta, Suresh Garg had successfully mention the need of compact size casualty evacuation stretcher and use of hinge joint to make the stretcher foldable. The stretcher design by them is purchased for mass production by Artificial Limb Manufacturing Corporation ALIMCO, Kanpur. Mr. Sudarshan Martande and Y. N. Jangale have designed a shock absorber using FEM tool and have made its analysis successfully. Different parameters measured using FEM are very close to their actual values. Vajreshwari Umachagi,, Katta Venkatarmana gives idea about use of shock absorbers for vibration control of stretcher. Shock absorber works effectively only when they are implemented properly in the stretcher design. Arif Duran, Hayrettin Ozturk's study helps to make the stretcher safe for patients. Different requirements of patient and doctors from a good and effective stretcher are considered from a survey. Ace wire spring & form company inc. had given properties of different spring materials from their paper, helps to select proper material for spring design.

Conclusion

Use of shock absorbers can reduce shocks very effectively to a negligible value. This makes the design safer and more comfortable. Patient feels more comfortable and safer on this stretcher than traditional stretchers. And because of its compact size, it can be used in the army and emergency department.

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