

## Approach to the prophylaxis of back and neck lesions at the office job through a universal mechanical chair add-on part

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**Abstract:** The aim of this new development, this innovative proposal, was to develop a portable, mechanical add-on device for standard office chairs. The universally deployable add-on device should serve for the prevention of pain in the neck and back in office workplaces as well as aiding rehabilitation for those who already suffer such pain. The new development should provide the possibility of performing gymnastic impander and expander movements countering a preset, adjustable, mechanical resistance.

**Keywords:** Back pain, Neck pain, Office chair, Universal add-on part, Active pain prevention, Medical technology

### I. INTRODUCTION

Sitting automatically represents the application of biomechanical stress to the spinal column and, as a result, to the muscle groups linked to it; particularly to the area of the pelvis, cervical/shoulder girdle and the entire spinal column. Problems with the back resulting from work completed in a sitting position are the most frequent causes of occupational illnesses. The ever-increasing amount of work performed on computer screens means that phases of relief and relaxation from the strain are essential with regard to both the biomechanical system as well as the cardiovascular system if serious health problems are to be avoided. Remaining in one position for longer periods while completing office work is damaging to health.

Active, moving parts for the purpose of reconditioning are not provided on office chairs currently on the market. Complaints related to regions of the back, cervical spine and shoulder girdle are rising dramatically and resulting in increases in the inability to work. This aspect represents the focal point of our innovative concept. According to information from the Robert Koch Institute, 62% of the German population underwent medical treatment [1] for back problems in 2003. This information coincides with the results of a study completed by TNS Healthcare in 2008 whereby 70% of all women and 57% of all men in Germany suffered from back and neck pains [2]. The results of a questionnaire completed on people covered by the German AOK health insurance company in 2010 showed that "back pain" topped the rankings in respect of incapacity to work [3]. Back and neck pains top the list, being the main cause of employee absenteeism.

The new development with its innovative conceptual proposal (Fig. 1) fulfills the requirements demanded by the Berufsverbandes der deutschen Rückenschulen (German Association of Back Therapy Training) and Berufsverbandes deutscher Ärzte für Orthopädie (German Association of Orthopedic Surgeons) with regard to relief and relaxation phases when completing work while seated. The following explanation illustrates the realization of the concept.



Fig. 1 Illustration of the mechanical add-on device and its movement options

### II. APPLICATION

The newly developed concept, or rather the prototype should be capable of being attached to as many common office chairs as possible. The mechanical device can be fixed either to the backrest via an adapter plate or to the chair frame via a clamping device. Both fixation methods have been tested and proven satisfactory. The figure on page 11077, (Fig. 2) illustrates the attachment of the mechanical device to the backrest of a standard office chair.



Fig. 2 Front, side and rear views of attachment to a standard office chair

### III. STATIC LOAD TESTS

The first prototype was developed according to defined basic data. The basis for this was a person with a maximum weight of 120 kg. Assuming the application of an equal load to the levers (right/left), this produces a load of 60 kg on each. The degree of impander mobility was set to  $\pm 30^\circ$  and expander mobility to  $\pm 45^\circ$ . The force necessary to press the lever arms together or push them apart was set to a minimum of 35 N and maximum of 80 N. Both levers (right/left) have an angle of movement of  $240^\circ$ .

This data was defined and load tests were completed under laboratory conditions in order to simulate use by persons in practice. The continuous application of a load resulted in the necessity to optimize the system with regard to the adjustable mechanical resistance. Material weaknesses must be eliminated and the device operability improved.

### IV. CONCLUSION

The newly developed prototype intended to support the prevention of back and neck pain resulting from office work represents the development of a mechanical, portable add-on device for chairs which can be attached to practically all standard office chairs. This mechanical add-on device enables the person using the chair to perform impander and expander movements during work breaks or at intervals during work.

As a result, users of the chair do not require any auxiliary equipment to exercise their back and neck muscles. Considering the data and facts compiled from the questionnaires regarding health problems related to the back and neck suffered by the German population outlined at the beginning of this report, there is an urgent need to develop a concept aimed at preventing the causes of such disorders. The prototype developed illustrates an option in the prevention. The prototype within the concept presented was developed based on the DE 44 04 282 C2 [4].

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