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Conference Abstract

Neck Training @ home with Intelligent Headset

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Abstract

Context: Non-specific neck and shoulder pain (NSS) is an increasingly common disorder in Denmark and has statistically been experienced by half of the adult population within the last six months [1, 2]. The estimated societal and personal costs related to NSS amount to at least 13 billion DKR yearly. The reason for the NSS disorder reaching epidemic levels in Denmark and worldwide is primarily the introduction of computers, tablets and smartphones in peoples' private and professional lives and the resulting work habits and physical postures imposed by such devices [3]. Curing NSS often requires several visits to physiotherapists or chiropractic clinics and in most cases the patients receive treatment as well as instructions in rehabilitative exercises that can be performed at home.

Purpose: With this M.Sc. project we propose a tele-medical training assistant that will instruct and monitor the patient in doing these home exercises in the correct manner. The training assistant consists of the motion-sensor-equipped 3D audio headset, Intelligent Headset, developed by GN [4]. This headset is connected with a smartphone and controlled by the training assistant app developed. Using this headset, we can monitor the head movements of the patient very closely as well as give immediate auditory instructions and feedback.

Methods: We first validate the precision of the headset motion sensors and the resulting ability to detect certain patterns of movement using the high-precision 3D motion capture system, Vicon, as a reference. We then develop and implement an application which is able to recognize and give feedback on three common and scientifically approved types of neck rehabilitation exercises. We do this through a user-centred process involving both healthy users and users with neck problems, while receiving continuous feedback from domain experts, such as chiropractors and physiotherapists.

Results and discussion: The final implementation includes algorithms for detecting the movement patterns of the individual exercises, data recording of all motion sensors in the headset, instructions for initiating each exercise on the smartphone's screen and continuous auditory feedback when performing the exercises as well as a final overview of a patient's performance during the exercise. We conclude that the Intelligent Headset combined with a smartphone is a suitable and sufficiently precise platform for performing neck rehabilitation at home with the three types of exercises examined. Further studies are needed to develop and demonstrate the usefulness of the application both regarding usability, user experience and motivational factors. Also, a next obvious step is a clinical validation of the rehabilitation performed with the application as a training partner. Further studies are also to uncover what data needs to be sent and how these should be presented to the therapist.

Keywords

neck training and rehabilitation; Intelligent Headset; auditory feedback

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