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Murray, Mike; Lange, Britt; Chreiteh, Shadi Samir; Olsen, Henrik Baare; Søggaard, Karen; Sjøgaard, Gisela

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Physical workload on neck and shoulder muscles during military helicopter flight - a need for exercise training?

Murray M,¹, Lange B,^{1,2}, Chreiteh S.S,¹, Olsen H.B,¹, Sjøgaard K,¹, Sjøgaard G,¹

¹Institute of Sports Science and Clinical Biomechanics, University of Southern Denmark, Odense, Denmark

²Department of Anesthesia and Intensive Care Medicine, Odense University Hospital, Odense, Denmark

Introduction

Work-related neck/shoulder pain is a common complaint among military helicopter pilots and crew members. The flight helmet and additional Night Vision Goggles (NVG) place a considerable load on the cervical spine. The aim of this study was to quantify the physical workload on neck/shoulder muscles to assess possible overload that may call for exercise training to improve capacity and prevent neck pain.

Methods

Nine pilots and nine crew members from the Royal Danish Air Force participated in a standardized representative flight sortie encompassing: Patient transportation (A-B flight) and Search and Rescue (SAR flight). A standard helmet was used (1.85 kg). SAR flight was performed with NVG (1.1 kg) and A-B flight was performed +/- NVG. Before take-off, one pilot and one crew member were equipped with 6 wireless electromyography (EMG) sensors bilaterally above m. trapezius (TRA), upper neck extensors (UNE) and m. sternocleidomastoideus (SCM). Maximal Voluntary Isometric Contractions (MVC) was performed for normalization. A modified version of the observational method "Posture Activity Tools and Handling" (PATH) was used for assessing work positions during flights. For every minute, the head position of pilots/crew members were classified as: anatomically neutral (<30° flexed), flexed (>30°), extended (>30°), rotated (>30°) and/or laterally flexed (>30°).

Results

Mean measuring time was for A-B flight: 16.9 ± 5.1 min, for A-B flight + NVG: 22.7 ± 10.8 and for SAR flight: 21.3 ± 11.1. The mean muscle activity in % MVC was highest during SAR flight: pilots 2.9 ± 1.7 (TRA) 12.7 ± 5.2 (UNE) 4.3 ± 2.9 (SCM), Crew members 4.1 ± 3.8 (TRA) 10.5 ± 2.4 (UNE) 2.4 ± 1.5 (SCM). Muscle activity in UNE was significantly higher than in TRA and SCM during all flights, except for crew members when compared to TRA during A-B flight ($P = 0.086$). For crew members muscle activity in UNE was significantly higher during A-B flight + NVG compared to - NVG ($P = 0.021$), while no significant difference was found for pilots. Non-neutral head positions in % of SAR flight time were for pilots observed for 88.6% (flexed) and 64.4% (rotated), and for crew members for 93.8% (flexed) and 89.9% (rotated).

Discussion

The mean muscle activity during flights was overall ~ 10% MVC in UNE and even higher during SAR flight, which is considered a high sustained activity level. Such high workload in combination with the flexed and/or rotated positioning of the head may play a role for the high prevalence of neck/shoulder pain among this occupational group. The present exposure-assessment suggests that strengthening exercises for the UNE, lowering the relative load during flights, could potentially alleviate neck pain.