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Neck postures in air traffic controllers with and without neck/shoulder disorders

Inger Arvidsson[a,*], Gert-Åke Hansson[a], Svend Erik Mathiassen[b], Staffan Skerfving[a]

[a]*Division of Occupational and Environmental Medicine, University Hospital, SE-221 85, Lund, Sweden*
[b]*Centre for Muskuloskeletal Research, University of Gävle, Box 7629, SE-907 12, Umeå, Sweden*

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Abstract

Prolonged computer work with an extended neck is commonly believed to be associated with an increased risk of neck–shoulder disorders. The aim of this study was to compare neck postures during computer work between female cases with neck–shoulder disorders, and healthy referents. Based on physical examinations, 13 cases and 11 referents were selected among 70 female air traffic controllers with the same computer-based work tasks and identical workstations. Postures and movements were measured by inclinometers, placed on the forehead and upper back (C7/Th1) during authentic air traffic control. A recently developed method was applied to assess flexion/extension in the neck, calculated as the difference between head and upper back flexion/extension. Results: cases and referents did not differ significantly in neck posture (median neck flexion/extension: -10° vs. -9°; $p = 0.9$). Hence, the belief that neck extension posture is associated with neck–shoulder disorders in computer work is not supported by the present data.

Keywords: Case-referent; Computer work; Inclinometry

1. Introduction

Work-related musculoskeletal disorders (WRMSD) in neck and shoulders are frequently reported among computer operators (Gerr et al., 2002; Brandt et al., 2004). Several studies of clinical effects of disorders, or their mechanisms, have focused on the issue whether subjects with WRMSD show other patterns in motor performance, in terms of postures, movements and muscular load, than healthy subjects (Hägg and Åström, 1997; Vasseljen and Westgaard, 1997; Madeleine et al., 1999, 2003; Szeto et al., 2002).

These studies have shown conflicting results: Vasseljen and Westgaard (1995) found consistent associations between pain and increased activity in the trapezius muscles among manual workers, but not in office workers. In contrast, Hägg and Åström (1997) found that secretaries with neck/shoulder complaints had fewer episodes with relaxed trapezius muscles, compared to healthy referents. Madeleine et al. (1999, 2003) found differences in some kinetic and kinematic parameters between workers reporting pain and pain-free subjects while performing a standardised cutting task, while Vasseljen and Westgaard (1997) did not find any significant differences in trunk and arm postures among office workers with and without disorders.

A common clinical conception is that prolonged computer work with an extended neck can lead to neck–shoulder complaints. In the literature, a similar "forward head posture" is described, and defined as a combination of "extension of the upper cervical spine and flexion of the lower cervical spine" (Szeto et al., 2002; McLean, 2005). Chiu et al. (2002) found that 60% of computer operators with neck pain reported such posture. Using a two-dimensional video-based motion-analysis system, Szeto et al. (2002) showed non-significant trends of increased forward head posture among female symptomatic office workers, compared to asymptomatic controls.

The sparse, available literature shows varying opinions concerning whether neck–shoulder pain influences motor performance during work. More data is needed comparing

*Corresponding author. Tel.: +46 46 17 31 75; fax: +46 46 17 31 80.
E-mail address: inger.arvidsson@med.lu.se (I. Arvidsson).

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motor performance in general among subjects with and without disorders, and particularly regarding neck postures in computerised work.

In air traffic control, a large group of subjects perform exactly the same work tasks in identical workstations with a large element of computerised activities. The aim of the present study was to find out whether subjects with clinically defined neck–shoulder disorders performed this work in neck postures and movements, as measured by exact technical measurements, different from those of healthy referents.

2. Methods

2.1. Study population

At baseline, the study group consisted of all female certified air traffic controllers ($n = 70$) employed in a Swedish Air Traffic Control Centre. All had been working with air traffic control more than 20 h/week for at least 3 months. All had the same education, the same work tasks and identical workstations.

The air traffic controllers were sitting in front of circular radar screens (diameter 500 mm, lower edge 80 mm over the desk top, not adjustable) and kept paper strips with airplanes information in holders at the desk in front of them. Changes in height, speed or course of the aircrafts were noted manually on the strips. The controllers used a microphone and headset for communication with the aircrafts, as well as a keyboard and trackball which were fixed and placed with a distance of 425 and 460 mm, respectively, from the edge of the desk. The desks were 735 mm in height and not adjustable, which were the chairs. The air traffic controller worked for more than 5 h per shift at the workstation. The air traffic intensity, and thus the intensity of work operations, varied widely between different working periods (10–30 aircrafts per hour).

2.2. Selection of cases and referents

The selection of cases and referents was based on an interview regarding musculoskeletal complaints and a standardised physical examination of neck, shoulders and upper back, performed twice at an interval of 1.5 years. For inclusion as a case or referent, strict criteria had to be fulfilled by the individual at both occasions.

2.2.1. Interview

The subjects were asked about musculoskeletal complaints from neck, shoulders and upper back (Standardised Nordic Questionnaire, SNQ; Kourinka et al., 1987) the last 12 months and 7 days. The frequency of the complaints was reported (never = 0, seldom = 1, sometimes = 2, often = 3 and very often = 4; Holmström and Moritz, 1991). The subjects were asked if the complaints were caused or associated with the work.

Furthermore, incidence of eye strain or eyesight difficulties, use of spectacles/contact lenses and if the subjects were satisfied with their spectacles/lenses, was asked.

2.2.2. Physical examination

A standardised physical examination (Ohlsson et al., 1994) of the neck, shoulders and upper back, was performed by the same physical therapist. Diagnoses were made according to predefined criteria. In the original method, the diagnoses Tension neck syndrome, Cervical syndrome, Cervicalgia, Thoracic outlet syndrome, Frozen shoulder, Supraspinatus tendinitis, Infraspinatus tendinitis, Bicipital tendinitis, and Acromioclavicular syndrome are included. In the present study, the diagnosis Trapezius myalgia (current pain from the neck and tender and restricted trapezius muscle/s) was added to the original set of diagnoses. Each subject could receive multiple diagnoses. The findings were noticed in three degrees of seriousness (none = 0 point, moderate = 1 point and severe = 2 points). The sum of the points was, for each individual, calculated as the "findings score" for each body segment, and totally for the neck/shoulders/upper back (0–244 points).

2.2.3. Inclusion criteria

Inclusion criteria for *the cases* were reported complaints "often" or "very often" during the last 12 months, and neck/shoulder diagnosis or at least 20 points in the findings score in the physical examinations, at both occasions. Inclusion criteria for *the referents* were reported complaints "never" or "seldom" during the last 12 months (if "seldom" was reported, no present work related complaints were allowed), no diagnosis and a low finding score (<6) at both occasions. This selection identified 13 cases with neck–shoulder disorders and 11 healthy referents out of the original 70 subjects in the study base. All cases had disorders in the neck, and 12 out of 13 were also affected in shoulders and/or upper back. Characteristics of the cases and referents are shown in Table 1.

All certified air traffic controllers regularly undergo occupational eye examinations.

Optical corrections were used by 11 out of the 24 included air traffic controllers, seven of the 13 cases (54%) and four of the 11 referents (36%), as specified in Table 1. Most (8/11) were satisfied with their spectacles/lenses, while two of the cases and one of the referents were dissatisfied or quite dissatisfied. Three cases and two referents reported eyesight difficulties. The cases reported eye strain to a higher extent than the referents (nine cases (69%) vs. one referent (9%); $p = 0.01$).

2.4. Measurements of postures and movements

The 24 women performed an ordinary work period in authentic air traffic control, during, in mean 56 min (range 36–66). The subjects were instructed to assume their habitual postures and way of working and to adjust the