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Ergonomic evaluation of office workplaces with Rapid Office Strain Assessment (ROSA)

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Abstract

The regular use of the computer in the office contributed to the appearance of many risk factors related with work-related musculoskeletal disorders (WRMSD) such as maintaining static sitting postures for long time and awkward postures of the head, neck and upper limbs, leading to increased muscle activity in the cervical spine and shoulders. The objective of this study was to evaluate the presence of risk factors for WRMSD in an office using the Rapid Assessment Office Strain method (ROSA). Based on the results of this ergonomic evaluation, an occupational gym program was designed and implemented. Thirty-eight workplaces were evaluated using the observation of the tasks and pictures records in order to characterize those tasks in more detail. The ROSA tool was applied by an observer, who selected the appropriate score based on the worker's posture as well as the time spent in each posture. Scores were recorded for the sections of the method, specifically Chair, Monitor and Mouse and Keyboard and Telephone. The scores were recorded in a sheet developed for the method. The mean ROSA final score was 3.61 ± 0.64, for Chair section was 3.45 ± 0.55, to Monitor and Telephone section was 3.11 ± 0.61, and to Mouse and Keyboard section was 2.11 ± 0.31. The results led to understand that the analyzed tasks represent situations of risk of discomfort and, according to the methods guidelines, further research and modifications of the workplace may be necessary. It should be emphasized that these scores may not be related to the poor available equipment but with the need to optimize their use by the workers. It was noticed also that the interaction of workers with the tasks and the adopted sitting posture at the computer throughout the day have effects at a muscular level, essentially for the cervical area and shoulders. ROSA tool is an useful and easy method to assess several risk factors associated with WRMSD, also allowing the design of specific occupational gym programs.

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Keywords: Work-related musculoskeletal disorders; Rapid Assessment Office Strain method (ROSA); Occupational gym

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1. Introduction

The appearance of work-related musculoskeletal disorders (WRMSD) at the offices as rise over the last years, mainly because of the regular use of computers at the workstations [1–3] increased the occurrence of WRMSD reported [4] mostly on neck and upper limbs [3,5]. WRMSD are the reason for a high proportion of sickness absence from work than any other health condition, approximately a half of all work-related disorders in European Union members. In the fourth European working conditions survey, almost a quarter of European workers report muscular pain in their neck, shoulders and upper limbs [6]. This problem associated with the use of the computer in offices had been related to neck, upper limbs and back segments [3,4,7,8].

Office work represents a complex physical work environment, with interactions among the various dimensions of the workstation and equipment, speed of data entry, position and lighting of visual targets (screen and documents), and job content. This type of work have been related with some WRMSD risk factors like awkward, or critical, postures, prolonged static sitting, sustained non-neutral postures of the upper limbs, static low load or repetitive work, increased muscular activity in the upper back and shoulders, duration of the work and time pressure [8–10]. It was known that many office workers spend more than 75% of their work time seated at a computer [11,12].

The relationship between sitting posture and cervical spine and shoulder changes have been extensively studied. Although it seems that there are no studies able to attest a clear relationship between posture, muscles motor activity and WRMSD [1], some authors have shown that a sustaining static posture for longs periods of time is related to persistent muscular activity on the spine and shoulder stabilizers [13], even at low loads [14]. Most of this risk explained above are related with the interaction between the office workers with components of the workstation such as the desk, chair, monitor, mouse, keyboard and telephone [15–17].

The prevention of WRMSD among office workers depends on accurate identification of exposure to occupational risks. Many studies about the association between risk factors and the resulting WRMSD have used several approaches to characterizing working posture. The goal of workplace study is to proactively identify factors associated with increased risk of musculoskeletal disorders. The three approaches that have been used to identify risk factors related to WRMSD are the worker self-report, where the worker is asked to estimate the risk factor levels associated with their own work; the observation-based methods, where a job analyst observes the work in real time or from recorded video, with a systematic approach to classifying risk factors; and the direct measurement, where instrumentation is used to measure posture directly [18]. Observation-based assessments appear to provide the levels of costs, capacity, versatility, generality and precision accorded to the needs of occupational safety and health specialists who have limited time and resources at their disposal and need a basis for establishing priorities for intervention [19]. Some examples of this type of assessment are the Rapid Upper Limbs Assessment (RULA) [20], the Rapid Entire Body Assessment (REBA) [21] and the Rapid Office Strain Assessment (ROSA) [22]. This last one is a recent office workplace assessment method and is based on other methods, such as RULA and REBA.

The ROSA method is a diagram-based checklist that was developed to quickly quantify the exposure of workers to risk factors in office workplaces and if an office workplace requires additional assessment or intervention. This method is based on the CSA standards for Office Ergonomics (CSA-Z412) and the musculoskeletal risk factors are identified through extensive research specific to office and computer work. The risk factors incorporated into the tool are organized into several subsections like chair, monitor and telephone, and mouse and keyboard. These subsections emphasize the risk factors of each component of the office workplace and weigh risk scores. The scores verified in each subsection are then combined to achieve a ROSA final score, indicative of the overall risk of musculoskeletal discomfort, as a result of the office organization [22].

To design an occupational gym program that could be effective to decrease WRMSD in office workers it is necessary to analyze properly the postures and the interactions between the worker and the components of the workplace to know which exercises would be more accurate to minimize the risk factors of the office work. Therefore, the aim of this study was to evaluate the presence of risk factors for WRMSD in an office of an insurance company using the Rapid Assessment Office Strain method (ROSA). Based on the results, an occupational gym program was designed and implemented.

2. Methods

2.1. Study sample

This study was conducted in an insurance broker, placed in Porto, Portugal, between September and December of 2013. The sample was composed intentionally by thirty eight office workers who participated in an occupational gym program. The participation was done in a voluntary basis.

All workers usually perform their functions in a sitting posture and work with office tools like computer (monitor, keyboard and mouse), telephone and documents.

2.2. Procedures

The workers' assessment were conducted by an observer that started the ergonomic evaluation by meeting with the human resources department of the company to understand the type of work that workers develop. This meeting allowed to understand what are the most frequent adopted work postures, as well as their schedules.

The analysis begun with the workplaces observation and a brief interview with the workers to understand their work composition. Some pictures were collected with the workers at their workplaces.

After that the ROSA method was applied by using the pen and paper checklist. The ROSA method developed by Sonne et al. [22] has been designed to quickly quantify the risks associated with computer work and to establish a level of action to characterize the level of risk of the workplace and to know the postures that workers adopt at the workplace.

2.3. Statistical analysis

Data were analyzed through a descriptive statistics (mean, standard deviation (SD) and percentages). All the statistical data analysis was carried out using SPSS program (version 22).

3. Results

3.1. Sample characterization

The current study was conducted with 38 participants. There were 78.9% of females and 21.1% of males. Table 1 describes the sample characteristics.

Table 1. Sample characteristics.

Characteristic	Mean (sd) or %
Age (years)	39.2 (7.7)
Weight (kg)	67.0 (13.1)
Height (m)	1.7(0.1)
Body mass index (kg/m^2)	24.4 (4.0)
Smoking status	28.90%
Physical activity status	52.6%
Length of service (years)	8.9 (8.2)
Past history of illness	34.2%

Firstly, an overall assessment of the workplace was done with the main goal characterizing it. By the direct observation and the records made during the visits, it was observed that workers are mostly in the position of sitting in an open space office. Of the normal office tasks (reading of documents, writing on paper, computer work, making

copies, call answering), the work with computer and answering the telephone were the ones that have a greater importance. The workplaces are equipped with desk, chair, computer (monitor, keyboard and mouse) and telephone.

The mean ROSA score obtained for subsection A "Chair" are presented in table 2.

Table 2. ROSA scores for subsection A "Chair."

Subsection A – Chair	ROSA scores [mean(sd)]
Chair height	1.21 (0.47)
Chair depth	1.18 (0.39)
Armrests	1.68 (0.53)
Back support	1.47 (0.51)
Duration	1.00 (0.00)

After the table analysis, it is verified that the major scores are in the armrests 1.68 (0.53) and in the back support 1.47 (0.51).

The mean ROSA score obtained for subsection B "Monitor and Telephone" were in table 3.

Table 3. ROSA scores for subsection B "Monitor and Telephone."

Subsection B – Monitor and Telephone	ROSA scores [mean(sd)]
Monitor	3.24 (0.54)
Telephone	2.53 (0.83)

After the analysis of the table, it is verified that the ROSA score for monitor is 3.24 (0.54) and for telephone is 2.53 (0.83).

The mean ROSA score obtained for subsection C "mouse and Keyboard" were in table 4.

Table 4. ROSA scores for subsection C "Mouse and Keyboard."

Subsection C – Mouse and Keyboard	ROSA scores [mean(sd)]
Mouse	2.11 (0.31)
Keyboard	1.18 (0.46)

The mean scores by section and the mean ROSA final score were in table 5.

Table 5. ROSA scores by section and the ROSA final score.

Sections	ROSA scores [mean(sd)]
Subsection A – chair score	3.45 (0.55)
Subsection B – monitor and telephone score	3.11 (0.61)
Subsection C – mouse and keyboard score	2.11 (0.31)
ROSA final score	3.61 (0.64)

The mean ROSA final score was 3.61 (0.64) that means that the workplaces presented musculoskeletal discomfort risk and that requires investigation and modifications can be necessary.

4. Discussion

This study aimed to evaluate the presence of risk factors for WRMSD in an office of an insurance company using the Rapid Assessment Office Strain method (ROSA) and based on the results an occupational gym program was designed and implemented.

Regarding the chair assessment, most of the workers had the chair height with the knees approximately 90º and the pan depth at about approximately 3 inches (7.6 centimeters). At the level of the armrests, many workers not used, being the arms supported on the desk what often causes elevation of shoulders and, consequently, the increase of tension in the muscles of the neck and shoulders, as the trapezius muscle. Some studies demonstrated that supporting the forearm on the work surface may increase comfort and decreased muscular load of the neck and shoulder [23]. As for the lumbar support, some workers did not present the lumbar spine supported in the chair, with the trunk flexion, which increases muscle activity in that area. For the time sitting, all workers were more than four hours in this posture, so the score was assigned the highest. Maintaining a posture of sitting during long hours in static postures and sometimes inadequate, causing some problems to the worker related to muscular activity maintained stabilizers muscles of the cervical spine and shoulder [24,25]. This constant activity may cause muscle fatigue and making more susceptible the appearance of WRMSD.

The scores assigned to the monitor are related to the positioning of the head in relation to the same, where workers are often with very low screen, forcing a flexion of the cervical spine, as well as all workplaces do not present the documents support, which forces workers to flex and/or rotate the neck to analyze the papers placed on the side part of the desk. The constant movements of flexion or rotation of the cervical spine can cause pain in the head and shoulders. At the level of the neck and in the trapezius muscle region, it is known that there is a positive relationship between the flexion of the neck and musculoskeletal symptoms in this site as well as in the lumbar spine, whose combined movement of flexion and rotation of the trunk and forced movements are related to the presence of pain [26]. As for the phone, most workplaces jobs did not have available headsets, which forces workers often holding the phone between their head and shoulder causing a large strain on the spine and shoulder musculature [27]. In order to keep a static posture, the muscles of the neck, shoulder and upper limbs became overloaded and finally injured. Especially the discomfort postures due to poor viewing angle of the screen and the position of the chair and table may shorten the soft tissues, and cause muscle tension, weakness and fatigue. It has been documented by some researchers that the muscular tension and stress to the shortened structures may cause pain [8,28].

The scores obtained from mouse analysis were related to the fact that many workers often do not put the mouse aligned with the shoulder, forcing the shoulder in abduction. Non-neutral postures of the shoulder like flexion and abduction have been found to be associated with musculoskeletal symptoms of the neck and upper limbs [1,10]. Another situation were related to the time that the work use the mouse, which is higher than the four hours, being known that intensive mouse use for long periods of time are particularly related with the increased of WRMSD [7], most of the times in the neck and in the wrist [15]. As for the keyboard, most of the workers presents the keyboard well positioned with their hands aligned with the forearm. Although the keyboard and mouse positioning are appropriate in most of the cases, their constant use gives rise to a constant muscle recruitment, particularly of the trapezius muscle, which can lead to more severe musculoskeletal symptoms [24,25], being essential to introduce active breaks that can help in the relaxation of this muscle.

From the analysis of the final score of the ROSA method, it turns out that the average level is of 3.61 (0.64) which indicates that the workplaces can cause discomfort and, according to the method guidelines, further investigation and modifications might be required. This value does not relate directly with the bad equipment in the workplace but rather with the improvement of workers' posture, optimizing its use. From the application of the method, it was noticed that the posture of sitting at the computer that workers adopted throughout the workday and its interaction with the other elements of the workplace can cause muscle tension in the neck and shoulder segments. There are still unilateral postures like when workers hold the phone between their head and shoulder which cause muscle fatigue and decreased flexibility due to the tension that prevents the muscles from working on his greatest performance. Thus, the adoption of an occupational gym program planning, focused on exercises that have as goal

the relaxation of the musculature of the neck and shoulders segments, may decreased fatigue and, consequently, minimize pain and increase workers' flexibility.

5. Conclusion

The obtained results led to understand that the analyzed tasks and workplaces represent situations of risk of discomfort and, according to the method guidelines, further research and modifications of the workplace may be necessary. It should be emphasized that these scores may not be related to the poor available equipment but with the need of optimize their use by the workers. It was noticed also that the interaction of workers with the tasks and the adopted sitting posture at the computer throughout the day have repercussions at a muscular level, essentially for the cervical and shoulders segments. ROSA tool is an useful and easy method to assess several risk factors associated with WRMSD, also contributing with appropriate data for the design of specific occupational gym programs.

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