Journal of Ergonomics
ISSN: 2165-7556

Ellapen et al., J Ergonomics 2014, S4
DOI: 10.4172/2165-7556.S4-001

Research Article Open Access

The Association of Unsound Sitting Posture and Vertebral Musculoskeletal Pain among University Administrators

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Abstract

Background: This study documented the prevalence of work related musculoskeletal pain of University of Kwa-Zulu Natal staff members who operate a computer for a minimum of 5 hours daily.

Method: Subjects completed a self-report musculoskeletal pain questionnaire, which gathered their demographical and work related musculoskeletal pain over the last 12 months. The following descriptive statistics mode, mean, frequency, percentages and inferential statistics, chi-square ($p< 0.05$) were employed to analyse the data.

Results: One hundred and two (68.00%) of the cohort complained of musculoskeletal pain within the last 12 months (X^2 (1, N = 150) = 1.03E-05, $p<0.0001$). The most prevalent anatomical sites of musculoskeletal pain were; lumbar vertebrae (30.27%), shoulder (24.42%), cervical and thoracic vertebrae (22.80%) (X^2 (2, N = 102) = 6.65E-47, $p<0.0001$).

Conclusion: University of Kwa-Zulu Natal staff members complained of a high prevalence of musculoskeletal lumbar, shoulder, cervical and thoracic pain.

Keywords: Lumbar vertebrae pain; Computer data capturing

Introduction

Technological advancements have revolutionized office work making tasks easier, however they pose new problems of a different nature (one such problem being work related musculoskeletal disorders) [1,2]. The most vulnerable anatomical site of work related musculoskeletal pain is the vertebral column [1-3]. Long term computer use has been identified as a significant risk factor predisposing the operator to musculoskeletal complaints because of the flexed, constrained cervical, thoracic and lumbar vertebrae and protracted shoulder postures [3,4]. The screen height and keyboard position have a strong influence on the operator's neck, shoulders, elbow and trunk inclination [2,5,6]. Musculoskeletal vertebral pain has been associated to vertebral instability, compression vertebral fractures and prolapsed inter vertebral disc [7,8]. Risk factors for the development of work related musculoskeletal vertebral pain include frequent bending, twisting, lifting, prolonged static sitting and standing postures as well as unsound sitting posture [7,8].

Musculoskeletal vertebral pain adversely affects occupational productivity [7]. Many of University of Kwa-Zulu Natal (UKZN) staff members who frequently visit the Biokinetic Rehabilitative Clinic complained of work related musculoskeletal pain. The uniqueness of this paper is the identification of the association between flexed vertebral sitting posture and work-related musculoskeletal pain among UKZN staff, in South Africa. Although there is published literature of the association of unsound sitting posture and vertebral musculoskeletal pain among administrators from other parts of the world, no South African literature is available. The finding of this study must encourage further occupational research aimed to identify the biomechanical and other risk factors predisposing the UKZN staff to work related musculoskeletal pain.

Materials and Methods

Ethical acceptance of the study was obtained from the UKZN's Health Science Ethics Committee (HHS0224/010).

Sample and sampling method

One hundred and fifty UKZN staff aged 24-60 years old participated in a retrospective study by voluntary informed consent. Subjects were recruited from Westville campus of UKZN. The inclusion criteria for eligibility to participate in the study was that all subjects had to be UKZN staff members who operate a desk top and/or lap top computer for a minimum duration of five hours daily. All UKZN staff was contacted electronically and/or telephonically and subsequently those volunteering to participate in the study completed an informed consent form and questionnaire during an interview. In addition their body mass and stature were recorded.

Self-report musculoskeletal questionnaire: Subjects biographical, occupational and work related musculoskeletal pain information were gathered by employing the use of a validated questionnaire (the questionnaire was adapted from Orebro Musculoskeletal Pain Questionnaire [9,10]. In the self-report musculoskeletal pain questionnaire, the anatomical site of musculoskeletal pain, intensity/severity of work related musculoskeletal pain according to the Kee and Seo Pain Rating Scale and the type of work related musculoskeletal pain (dull aching, discomfort, sharp, pins and needles, numbness, burning and radiating) was recorded [11]. The definition of musculoskeletal pain employed in this study was any sensation of distress to the musculoskeletal system ranging from uncomfortable to worst pain

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Received January 17, 2014; **Accepted** February 25, 2014; **Published** March 04, 2014

Citation: Ellapen TJ, Narsigan S, Abrahams S, Desai FA (2014) The Association of Unsound Sitting Posture and Vertebral Musculoskeletal Pain among University Administrators. J Ergonomics S4: 001. doi:10.4172/2165-7556.S4-001

ever experienced, which inhibited the staff member from operating their computer for a minimum duration of 24 hours [10]. Subjects were requested to complete a self-report questionnaire, indicate only work related musculoskeletal pain, not musculoskeletal pain contracted from sport and other recreational activities.

Sitting work posture: Critical to the occupational data gathered were the sitting work posture adopted by staff (Figure 1). Figure 1 identifies two different sitting postures adopted by UKZN staff [8]. Position A, the whole back bent and the seat straight and position B, the person adopts a straight lower and upper back, neck bent, and the seat straight.

Data analysis

Data were analysed descriptively and inferentially. Descriptive statistical analysis included means, mode, frequency and percentages. Inferential analysis comprised of chi-square (x^2) ($p<0.05$).

Results

The results will be discussed in the following order; anthropometry and prevalence of work related musculoskeletal pain. The musculoskeletal pain will include anatomical site, intensity of pain, type of pain and sitting posture.

Anthropometric characteristics

One hundred and fifty UKZN staff members voluntarily participated in the study. Table 1 displays the physical characteristics of the sample according to specific anthropometric variables (body mass, stature, and age with regards to race and gender). Males were found to be heavier and taller than the female staff members. African females, White, Indian and Colored male UKZN staff members exceed the normative BMI rating (18.99-24.99 kg/m^2 as prescribed by ACSM, 2005) [12].

Sixty-eight percent (n=102) of the cohort experienced work related musculoskeletal pain within the last 12 months (X^2 (1, N = 150) = 1.03E-05, $p<0.0001$). There were 307 multiple anatomical sites of work related musculoskeletal pain occurrences within the last 12 months. The most prevalent anatomical sites of work related musculoskeletal pain were lumbar, shoulder and cervical (Figure 2). Vertebral musculoskeletal pain comprised of 53.13% which entailed cervical, thoracic and lumbar vertebral musculoskeletal pain (Figure 2).

The type of musculoskeletal pain sensations experienced by the staff were: sharp (10.15%), dull ache (57.03%), burning (5.46%), radiating (3.12%), pins and needles (11.71%), numbness (4.68%), discomfort (7.03%) and swelling (0.78%) (X^2 (4, N = 102) = 1.06E-58, $p<0.0001$). The intensity of musculoskeletal pain were; moderate (38.23%), low (18.62%), high (13.72%), uncomfortable (19.60%), and worst pain ever experienced (9.80%) (X^2 (5, N = 102) = 9.24E-15, $p<0.0001$).

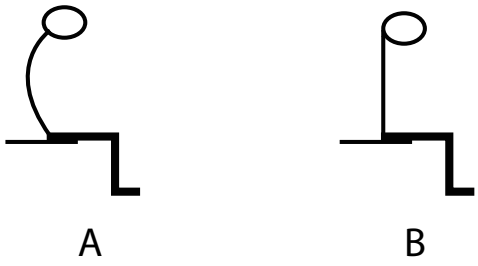

Figure 1: Two different sitting postures adopted by UKZN staff (adapted from Abduljabbar, 2008) [8].

The sitting work postures commonly adopted by the cohort were; A (n=115) and B (n=17) (6, X^2 N= 150) = 7.964E-29, $p<0.0001$) (Figure 1). Interestingly 31.78% of the cohort (n=48) did not experience work related musculoskeletal pain (X^2 (1, N = 102) = 1.03E-05, $p<0.0001$). A common characteristic among these 48 staff members is the persistent duration at their work station. These staff members worked for less than 60 minutes and then arouse and walked around. However the others remained in their sitting work posture for more than 60 minutes complained of musculoskeletal pain. During the interview staff were asked a close ended question determining whether they experienced musculoskeletal pain when operating their computers 60 minutes and beyond. All UKZN staff members complained of work-related musculoskeletal pain when they worked periods longer than 60 minutes (n=102) (X^2 (7, N = 102) = 1.03E-05, $p<0.0001$).

The average number of months the cohort was employed by UKZN was 133.33 (± 115.87). These UKZN staff members worked an average of 4.98 (± 0.22) days per week.

Discussion

The discussion of results will focus on the association between flexed vertebral sitting posture and lumbar, cervical and thoracic musculoskeletal pain.

Lumbar vertebral pain

One hundred and two staff members experienced work related musculoskeletal pain within the last 12 months which correspond with international work related musculoskeletal pain surveys [1,2,13]. Statistical interrogation of the data reveals that the lumbar vertebrae had the most musculoskeletal pain which concurs with previous literature [2,4,5]. Staff members who complained of musculoskeletal lumbar vertebrae pain adopted sitting posture A which involves excessive vertebral flexion. It is postulated that sitting posture A involves fixed femurs in relation to mobile pelvis and vertebrae. Prolonged sitting in posture A facilitates the posterior rotation of the pelvis in relation to the

Anthropometric Variables	White (n= 20)		Indian(n=82)		African (n=40)		Colored (n=8)	
	Male (n=3)	**Female** (n=17)	**Male** (n=39)	**Female** (n=43)	**Male** (n=18)	**Female** (n=22)	**Male** (n=3)	**Female** (n=5)
Body Mass (kg)	75.67 (± 26.27)	67.88 (± 8.36)	78.64 (± 12.23)	65.46 (± 11.09)	76.60 (± 15.46)	71.91 (± 15.59)	94.80 (± 18.38)	80.70 (± 14.53)
Stature (m)	167 (± 0.06)	1.61 (± 0.04)	1.71 (± 0.07)	1.58 (± 0.07)	1.72 (± 0.07)	1.61 (± 0.07)	1.72 (± 0.13)	1.62 (± 0.06)
Age (years)	34.33 (11.02)	44.65 (10.06)	40.71 (10.32)	39.62 (11.51)	35.33 (8.81)	35.64 (11.18)	40.00 (13.53)	37.00 (2.94)
BMI (kg/m^2)	26.74 (± 7.60)	22.02 (± 9.35)	26.76 (± 3.81)	24.23 (± 8.24)	24.29 (± 7.66)	25.44 (± 8.56)	31.93 (± 3.67)	24.62 (± 17.59)

Table 1: Physical characteristics of the sample population (n=150).

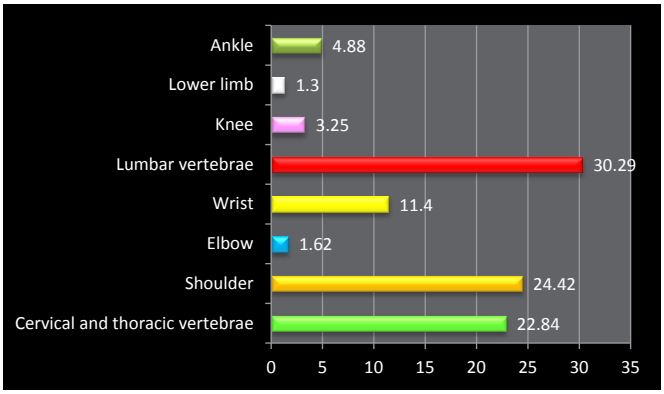

Figure 2: Graphical representation of the prevalence of work related musculoskeletal pain at multiple anatomical sites (X^2 (2, N = 102) = 6.65E-47 p<0.0001).

pair of fixed femur. However the person leans forward to gain a more precise view of the computer screen thereby eliciting lumbar vertebral flexion. This is clinical known as short arc pelvis on femoral hip extension [14]. The posterior pelvic rotation occurs due to concentric contraction of the gluteal muscles and eccentric contraction of the ilioposas in a closed kinetic chain. Similarly lumbar vertebral flexion is precipitated by the concentric contraction of the rectus abdominis and eccentric contraction of the erector spinae in a closed kinetic chain. Muscle action in closed kinetic chain actions moves the muscles' origin to the insertion [15]. It is postulated that prolonged posterior pelvic orientation alters the length of the anterior and posterior intervertebral and pelvic muscles that could produce vertebral pain. Further research needs to be conducted to validate this postulation.

Cervical and thoracic vertebral pain

The sitting posture adopted by UKZN staff members elicit cervical and thoracic vertebral flexion in an attempt to lean forward when working on their computers. The staff members focus their attention on the computer screen in front and below them which necessitated them to flex their cervical and thoracic vertebrae. This prolonged flexion of the vertebrae precipitates a kyphotic posture. The anterior neck muscles (sternocleidomastoid, scalene) concentrically contracts whilst the posterior muscles (splenius capitis, trapezius) eccentrically contract. Prolonged cervical vertebral flexion increases the risk of cervical extensor muscles becoming stiff and strained producing pain. Synergistic movement accompanying vertebral flexion is the anterior and inferior rotation of the rib cage due to the ribs attachment to the vertebrae facet joints. The anterior inferior rotation of the rib cage precipitates the concentric contraction of the internal intercostals muscles. The concentric contraction of the internal intercostals muscles increases the concavity of the rib cage which decreases the length of the muscles (serratus anterior, pectoralis minor and pectoralis major) which originate from the ribs to the scapula and humerus. The serratus anterior, pectoralis minor and major protracts/draws the scapula and humerus anteriorly and inferiorly [14]. Prolonged synergistic concentric contraction of the serratus anterior and pectoralis minor will enforce eccentric contraction of the lower and middle trapezius and rhomiod muscles. Prolonged eccentric contraction could facilitate muscle strains producing shoulder muscle pain.

The cohort was requested to subjectively describe the type of work related musculoskeletal pain sensation they felt. The type of pain sensation commonly experienced was dull aching, numbness, burning, sharp, and radiating and pins and needles. Brukner and Khan identify dull aching, sharp pain sensations as muscle pain [16]. The sum of the dull aching and sharp sensations equal 67.18% indicative of muscle pathology. Hagglund et al. reported that the combination of the anatomical site of musculoskeletal pain, intensity of musculoskeletal pain assessed by the Kee and Seo pain rating scale and type of musculoskeletal pain sensation is indicative of musculoskeletal pathology [11,17].

Conclusion

University of Kwa-Zulu Natal staff members experienced a high prevalence of musculoskeletal cervical, thoracic and lumbar pain.

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