ORIGINAL ARTICLE

CREATING A CULTURE OF PREVENTION IN OCCUPATIONAL SAFETY AND HEALTH PRACTICE: PERCEIVED BODY DISCOMFORT IN TWO SITTING POSITIONS

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ABSTRACT

Prolonged sitting is one of the factors for back discomfort. Sitting in the same position for long periods of time is worse. This experimental based study was conducted to achieve three objectives. There were to 1) identify whether is there any differences between perceived body discomfort among respondents before and after upright sitting, 2) identify whether is there any differences between perceived body discomfort among respondents before and after slump sitting and 3) compare the level of perceived body discomfort among respondents after two sitting postures. Thirty young and healthy adults were recruited as study respondents. Each respondent was asked to sit in a posture either upright or slump for 30 minutes. Respondents were then rated their body discomfort using Borg CR-10 scale before and after sitting. Another sitting posture was carried out after one day interval. There is a significant difference between perceived body discomfort among respondents before and after upright and slump sitting. Body discomfort of upright sitting was shown significantly greater than slump sitting. Although, slump sitting caused less discomfort than upright, but it proven by previous studies did not provide benefit to occupational safety and health practice in preventing occupational health related disease.

Keywords: *Upright sitting, slump sitting, back discomfort, safety and health, injury prevention.*

INTRODUCTION

In this modern era with high advanced of technology, people spend a lot of their time in sitting while working or driving. Increases in sitting time signify that decrease in physical activities. In Malaysia, 14% of the population complained of musculoskeletal pain and 12% of the population had low back pain (LBP)[1]. There is a sign that indicate the number of people suffering in LBP will increase in future[2]. From the Social Security Organization (SOCSO) Malaysia database in 2012, there were 499 cases of Musculoskeletal Diseases (MSDs) reported and it showed an upward trend of MSDs cases as compared to previous years. Many researchers found that sitting itself is not an independent causative of MSDs[3,4]. Sitting with combination of other factors will have the possibility of having MSDs[5].

Sitting posture is an important factor to prevent future MSDs. When sitting is affected by an awkward body posture, the human musculoskeletal system is compromised[6]. A proper sitting posture can protect our lumbar spine from getting injury. A proper posture will also keep bones and joints to be in a correct alignment, decrease the abnormal wearing of joint surfaces, reduce stress on the ligaments, prevent fatigue and strain and also prevent unnecessary pain. Signs of perceived discomfort such as tension, fatigue, pain, suffering or tremors, are the predictors of LBP[7].

Although awkward posture while sitting were not been well investigated but it is believed that there is a strong association with the presence of LBP[5].De Carvalho et al.[8]emphasize that the sitting posture plays a role in generating low back pain. So in order to prevent getting MSDs from sitting, it is important to study the significant body part that generated pain by sitting posture. There are many different types of sitting posture, for example, upright sitting, forward leaning sitting and slump sitting. Among these different types of sitting, it is necessary to identify which what type of posture that lead to minimum lumbar spine load during sitting and perceive less discomfort. Different sitting postures will lead to different body discomfort. Table 1 shows previous studies about sitting and its combination factors that may put human at risk. The sitting postures that investigated in this study were upright and slump sitting.

Table 1- The risk factors of occupational health problem due to sitting

Author	Significant Factor	Non-significant Factor
Syazwan et al.[6]	Sitting with whole body vibration or awkward posture or the combination of these two	Sitting solely
Chen et al.[9]	Prolonged sitting at work	Sedentary Lifestyle
Roffey et al. [4]	Sitting without appropriate movement for prolonged period	Sitting solely
Levanon et al.[10]	Awkward postures	Sitting solely

According to O'Sullivan et al.[11], upright sitting involves rotation of the pelvis anteriorly in order to ensure lordosis in a neutral position, relaxation of the thorax, thoraco-lumbar spine extended and slightly retraction of shoulder blades. While slump sitting posture involves posterior rotation of the pelvis, the relaxation of thoraco-lumbar spine and eyes looking straight ahead. Figure 1 shows upright sitting posture (A) and slump sitting posture (B).

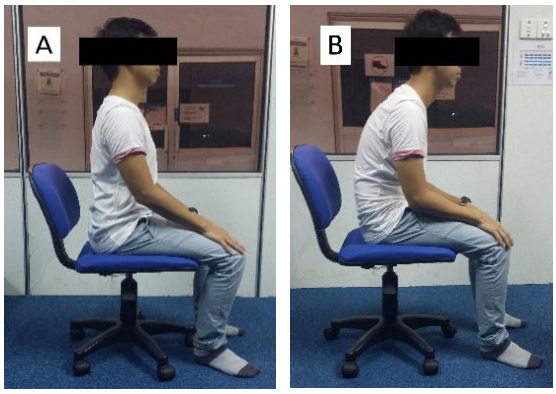

Figure 1 - (a) Upright sitting, (b) Slump sitting

This research was carried out in order to achieve two objectives, which were: (1) to identify whether is there any differences between perceived body discomfort among respondents before and after two types of sitting, upright and slump sitting, (2) to compare the level of perceived body discomfort among respondents after two sitting postures.

METHODS

Subjects

Thirty young and healthy adults in the range of age between 22 - 26 years old (mean = 22.20 and SD = 1.3) were recruited as respondent for this study. All respondents were ensure to fully understand of the procedures and objectives of the study and signed a consent form.

The respondents were selected based on the inclusion criteria such as healthy and asymptomatic of musculoskeletal disease. Respondent who had experience of severe musculoskeletal pain in the preceding 12 months, current or past history of known spinal disorders, signs of neurological deficit, osteoarthritis, rheumatoid arthritis, gout, kidney diseases, open wound or contusion at the buttocks or posterior thigh region and also pregnant will be excluded in this study.

In addition, candidate who has body mass index (BMI) less than 18.5 kg/m^2 or more than 23 kg/m^2, were also considered as unhealthy and excluded for this study. The results obtained then were analyzed using Statistical Package of Social Science (SPSS) software.

Questionnaire

Borg CR-10 scale was used to collect perceived body discomfort before and after sitting. This questionnaire aimed to determine each respondent's level body discomfort before and after upright and slump sittings. The Borg CR-scale was presented together with a body map so that respondent could indicate parts of their body experienced discomfort. There were a total of 19 body parts tested, which were head, neck, chest, waist, lower torso, upper back, mid back, lower back, left and right shoulders, left and right upper arms, left and right lower arms, left and right thighs, left and right lower legs and hip and level of discomfort felt was recorded.

Nordic Musculoskeletal Questionnaire was used to identify the prevalence of reported symptoms of pain and intensity of pain in the past 12 months. This procedure was carried out to fulfill the study criteria which excluded respondents that have neck and back injuries for the past 12 months. Those who experienced neck and back injuries in the preceding 12 months may affect the result.

Study Protocol

Each subject was required to sit in two sitting postures (upright and slump) on two separate days with at least one day interval after the first activity. The sequence of sitting posture was assigned randomly. During the experiment, respondents sat on the office chair with their hips and knees flexion 90°, arms were put on their lap and feet flat on the floor.The office chair was accommodated to each respondent as it is an adjustable.

During the sitting period, respondents were instructed to maintain the assigned sitting posture as much as possible and to avoid talking and laughing. The respondents were allowed to have subtle movement if they felt too much discomfort.

RESULTS AND DISCUSSION

The demographic information of the respondents were presented in Table 2. The mean difference of body discomfort scale for mid back, lower back, upper back, and left shoulder, right shoulder, left lower leg, right lower leg, neck and hip were recorded in Table 3.

Table 2 - *Demographic Information of Respondents (n=30)*

Characteristics	Mean (SD)
Age (year)	22.20 (1.30)
BMI (kg/m^2)	20.22 (1.59)
Gender	**Number**
Female	15
Male	15

In upright sitting, the p-value obtained for all body parts except left and right shoulder was less than 0.05. Thus, there is a significant evidence shows that there is a difference of perceived body discomfort before and after upright sitting. The result indicated that remain sitting for upright posture for thirty minutes is long enough to generate noticeable discomfort. For neck, upper back, mid back, lower back, left lower leg, right lower leg and hip, these parts have a p-value less than or equal to 0.001 ($p \leq 0.001$). Therefore, mentioned body parts have the greatest significant of body discomfort after thirty minutes upright sitting as compared to other body parts. By comparing differences between before and after sitting, it was found that the body discomfort at mid back was higher than at lower back and upper back. Whereas the body discomfort at lower back was higher than at upper back, and it followed by hip, neck and both lower legs.

Table 3 - *The Mean Difference of Borg Scores in Nine Body Regions*

Body Part	Mean Difference of Borg Scores	
	Upright	Slump
Mid Back	1.767***	1.450***
Lower Back	1.600***	1.450***
Upper Back	1.467***	1.317***
Hip	0.767***	0.767***
Left Shoulder	0.600	0.800***
Right Shoulder	0.583	0.883***
Neck	0.533***	0.533***
Left Lower Leg	0.350***	0.250
Right Lower Leg	0.350***	0.250

***Significant at p-value ≤ 0.001

In slump sitting, the p-value obtained for all body parts were less than 0.05. Thus, significant evidence shows that there is a difference of perceived body discomfort before and after slump sitting. Same as the upright sitting, the result signified that sitting for slump posture without changing posture for 30 minutes enough for body to generate noticeable discomfort. For neck, upper back,mid back,lower back, left shoulder, right shoulder, and hip, these parts have a p-value less than or equal to 0.001 ($p \leq 0.001$). Thus, for these body parts there have the greatest significant body discomfort after 30 minutes of slump sitting as compared to other body parts. By comparing differences of before and after sitting, it was found that the body discomfort at mid back is same as the body discomfort at the lower back. Both mid back and lower back discomfort was higher than upper back. While the body discomfort at the right shoulder was higher than at the left shoulder followed by hip and neck.

Mann Whitney U test indicated upright sitting was significantly greater than slump sitting, ($U=146$, $p= 0.160$). Both u-value and p-value proved that there is significant evidence shows that the level of perceived body discomfort of upright posture is higher than in slump posture. The result of this research was concurred with a research conducted by Waongenngarm, Rajaratnam, and Janwantanakul[7]. They also found that the body discomfort at the upper back, low back, neck,

shoulders, hip and both thighs ($p \leq 0.05$) after upright sitting were significantly greater than before sitting. Besides that, it also found that the body discomfort at the upper back, low back, neck, shoulders, hip and both thighs ($p \leq 0.05$) after slump sitting were significantly greater than before sitting. In the same research, they also concluded that upright sitting will be causing more body discomfort compared than slump sitting.

The reason for upright sitting generated more body discomfort may because of upright sitting position associated with increased postural muscle activity and activation of muscle lead to muscle fatigue and tension, thus it induced body discomfort easily [11]. Upright sitting was associated with high level of muscles activation, particularly of muscles such as thoracic erector spinae, iliocostalis longissimus pars thoracis and external oblique[12,13]. As a result, upright sitting caused greater fatigue and discomfort[14]. During upright sitting, human body requires much support from back muscle to maintain the lumbar spine in straight position. While in slump sitting, less muscle needed to support the lumbar spine, therefore slump sitting is more comfortable than upright sitting. This explained why many people tend to choose slumped sitting position instead of upright sitting[15]. In a book by Mckeown[16], it stated that maintaining an upright posture is particularly fatiguing, so people opted to slump sitting to feel relax. The result of this research clarifies that behavior of people in choosing slump sitting posture.

However, as compared to upright sitting, slump sitting tends to decrease postural muscle activity and increased lumbar flexion. When postural muscle activity decreases, the lumbo-pelvic region becomes dependent on its passive structures to maintain the position against gravity[7]. This phenomenon makes the spine susceptible to injury. Moreover, increased lumbar flexion in sitting is considered problematic since it increases LBP symptoms[17]. While upright sitting involved lumbar lordosis, thus this posture is suggested by many of the physiotherapists in choosing the best ideal sitting posture[14]. Although, slump sitting caused less discomfort than upright, but it does not provide benefit to human musculoskeletal system. Despite lack of evidence of clear superiority of upright sitting over other sitting posture, but there are still many researchers suggest that upright sitting was appropriate than slump sitting for long hour sitting[7,18,19].

CONCLUSION

The result showed that there was a significant difference after thirty minutes of sitting as compared to before sitting for all nineteen body parts. After comparing the level of perceived body discomfort among respondents after upright and slump sitting, the result indicated that upright sitting posed a higher body discomfort than slump sitting. It showed that prolonged sitting in the same position may cause discomfort although the sitting posture is correct. So, to keep our body move is important to prevent any occupational safety and health related problems. However, this study still can be improved by looking at different sitting posture also such as forward learning posture and sitting without back support.

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