UPPER BODY POSTURE DURING TREE PLANTING WORK

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INTRODUCTION

Although injury rates in most industrial sectors have decreased in Canada over the past decade, injury rates in the forestry sector have not seen such a favourable decline; total days lost due to injury increased by nearly 40% from 2001 to 2004 (WSIB 2005, OFSWA, 2004). Forty-eight percent of injuries are work-related musculoskeletal disorders, and can be attributed to the repetitive nature of the work (Lyons, 2001). The aim of this study is to define upper body and trunk postures during the tree planting task that contribute to musculoskeletal symptoms among tree planters, and to determine whether posture remains constant throughout the work shift.

METHODS AND PROCEDURES

Fourteen tree planters (8 male, 6 female) from a reforestation camp in Northern Ontario (age 21.83(0.75) yrs, height 1.75(0.09)m, mass 75.7(8.8)kg) volunteered to participate in the study. Workers were filmed with a standard digital video camera for 15 minutes at both the start and the end of the work shift, for three consecutive work days. Trunk flexion and lateral bend were also recorded for 6 of the 14 subjects during a full work shift using a Virtual Corset (MicroStrain, VT, USA) worn at the sternum.

Five events of interest were identified during the tree planting task: 1. shovel at highest vertical position before entry into ground, 2. shovel entry into ground, 3. shovel at furthest horizontal position from the trunk, 4. shovel at closest horizontal position to the trunk, and 5. tree insertion into ground.

Video data were digitized using DartFish video analysis software (ProSuite 4.0, Lausanne, Switzerland). Trunk flexion, shoulder flexion, shoulder abduction and elbow flexion were determined for each of the above events for 10 planting cycles at both the start and end of the work shift.

Virtual Corset data were filtered using a low pass Butterworth filter with a cutoff frequency of 2 Hz. An amplitude probability distribution function (APDF) analysis was performed to determine 10^{th}, 50^{th} and 90^{th} percentiles of trunk flexion during the first 15 minutes of the shift, for 15 minutes 6 hours into the shift (end of shift), and during the entire shift.

A repeated measures ANOVA with 2 factors (day and time) was performed on the video data to determine differences in posture between days, and from start to end of a work shift. T-tests were used to determine postural differences in trunk flexion (Virtual Corset data) from beginning to end of the shift. Statistical significance was set to 0.05.

RESULTS

Upper body postural data are presented in Table 1 for each event in the tree planting

cycle. No significant differences were found from start to end of the work shift ($p>0.05$).

Table 1. Mean (SD) upper body posture data (combined for start and end of work shift) for events 1-5 in the tree planting cycle. (n = 14)

	Upper Body Angle (degrees)			
	Trunk Flexion	Shoulder Flexion	Shoulder Abduction	Elbow Flexion
1	39.4(11.6)	50.0(24.9)	60.9(10.0)	60.9(16.0)
2	64.6(12.9)	66.7(11.0)	15.3(5.4)	133.3(17.5)
3	84.5(12.0)	96.3(14.3)	17.9(2.3)	147.2(20.0)
4	102.2(10.7)	44.4(13.2)	36.0(10.4)	95.3(20.0)
5	105.3(8.2)	4.8(24.5)	64.7(23.5)	48.9(17.5)

Mean trunk angles for the 10th, 50th and 90th percentiles for the start, end, and full work shift are presented in Figure 1. Trunk angles were not significantly different from start to end of shift. Fifty percent of the work day (4.3 hours) was spent in trunk flexion greater than 45 degrees.

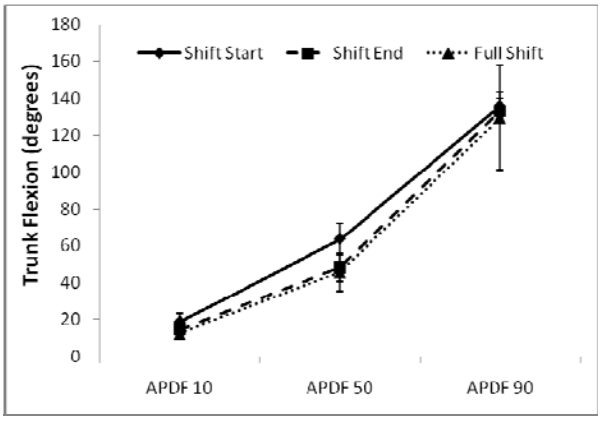

Figure 1. Mean APDF values for trunk flexion for the start of the shift, the end of the work shift, and the full work shift. Error bars are standard error of the mean. (n = 6)

DISCUSSION

The aim of this study was to define upper body and trunk postures during tree planting that contribute to musculoskeletal symptoms, and to determine whether posture remains constant throughout the work shift. Although studies have shown that worker *physiology* changes throughout the work shift (Roberts 2002, Trites et al, 1993), the present study suggests that upper body *posture* does not change. Therefore over the course of the work shift, workers must exert progressively higher physiological effort to maintain the biomechanical motions constrained by the work task itself.

APDF analyses show that workers spend 50% of the work shift at greater than 45 degrees of trunk flexion. Working in such a flexed posture may lead to a decrease in compressive strength of the spine, and may eventually lead to increased risk of disc failure (Gunning et al, 2001).

SUMMARY

Upper body posture in tree-planting does not change from start to end of the work shift. Fifty percent of the work shift is spent working in trunk flexion greater than 45 degrees. Large amounts of time spent in trunk flexion, coupled with the repetitive nature of the task may lead to an increased risk for developing low back disorders.

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