

CHAPTER I

INTRODUCTION

1. Rationale and background

Low back pain (LBP) is the most commonly found condition in the working age in both developed and developing countries (Hidebrandt et al., 1995). It has been reported that 60-80 percent of the working age group has ever suffered from this symptom at least once. Low back pain during the working period is the second cause for stopping working (Patenaude & Somer, 1987). Additionally, the number of low back pain patient has increased gradually in industrial countries. In USA, low back pain patients are five percents of all the adult population, therefore the USA government has to pay 7.2 billion dollars for medical treatment expenses with loss of gross income of 6-11 billion dollars every year (Frymoyer & Casts-Baril, 1987). To date, no researchers have reported the exact number of low back pain patients in Thailand, however, it has been reported that 10 percent of the total patients who receive medical treatment from the Orthopedic Department of Srinagarind Hospital of Khon Kean University have low back pain problems (Sodar, 1997).

Loading on the spine is claimed to be one of the causes of low back pain (Adams et al., 2000). Loading on the spinal column causes the spinal tissues, especially the intervertebral discs, to shrink which is mostly due to deformation and diffusion of fluid out of the intervertebral discs, known as “creep” (Adams & Dolan, 1995; Adams & Hutton, 1983). It has been shown that *in vitro* studies short-term loading results in an immediate relatively large loss of height which is quickly recovered automatically when the load is removed (Burns et al., 1984; Oliver & Twomey, 1995). The initial recovery after removal of load is rapid, and it then slows until equilibrium is approached (Figure 1).

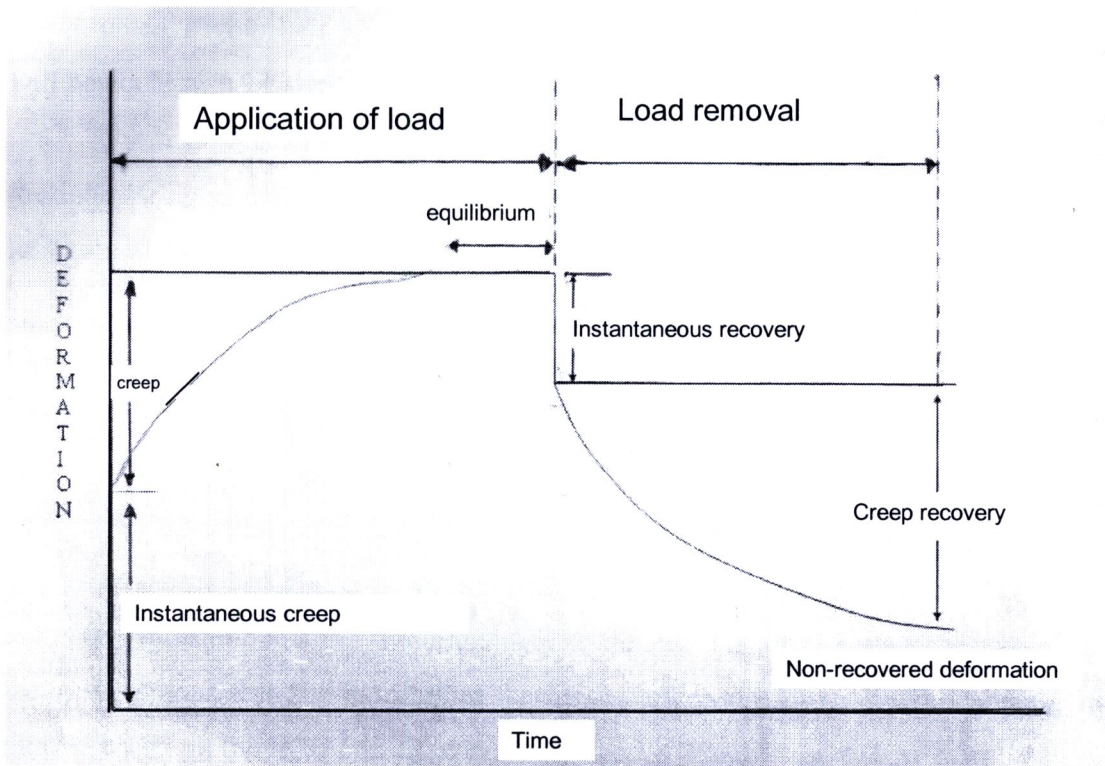


Figure 1 A typical creep and recovery curve (modified from Burns et al., 1984)

Vertical spinal creep (VSC) or height loss is creep that occurs in response to the effects of gravity (body mass) and to the addition of any extra load applied to the spine when the spine is in an upright posture (Adams & Hutton, 1983). Most tasks of daily living, for instance, static loading (Althoff et al., 1992; Eklund & Corlett, 1984; Puntumetakul et al., 2009; Troup et al., 1985), dynamic loading (Healey et al., 2008; McGill et al., 1996; Tyrrell et al., 1985) and vibration force (Bonney, 1988; Bonney & Corlett, 2003; Magnusson et al., 1992) are performed in upright postures and this could result in causing compressive loads to the spine and finally injure it. It is hypothesized that when the intervertebral disc and its surrounding structures have lost their fluid, this could result in less ability to resist pressure and stress, leading to the spine being easily injured (Wilby et al., 1987).

Moreover, the shrinkage of spinal vertebral periodically changes during the day (Healey et al., 2008). Research has shown that human height starts to decrease in the morning until bed time. The loss in height is about one percent of the body height.

For instance, if your height is equal to 2 meters when it is measured in the morning, it will be equal to 1.98 meters when it is measured in the evening.

From this observation, researchers hypothesize that afternoon activity, when the intervertebral discs and its surrounding structures have less fluid leading cause less capability to resist pressure or stress and this might injure spinal tissues more easily than morning activity. In contrast, some researchers have set up a hypothesis that during activities in the morning (forward bending) when there is high fluid in the intervertebral disc and its surrounding structures, the lumbar disc and ligaments are at greater risk of injury (Adams et al., 1987). According to these hypotheses, many researchers have tried to control the effect of diurnal variation by asking their subjects to perform some tasks such as weight lifting (Wilby et al., 1987), walking (Healey et al., 2008) and static loading (Puntumetakul et al., 2009) and comparing the amount of the VSC measured in the morning to that in the afternoon. However, the findings of diurnal effect on the VSC are still controversial.

Running is a form of dynamic loading that decreases disc height more rapidly than static loading (Leatt et al., 1986; Tyrell et al., 1985; White et al., 1990). Nowadays running on a treadmill is one of the popular exercises because this exercise is relatively convenient for people to perform. Some people would prefer to do it in the morning, but some would do it in the evening. To date, no previous studies have demonstrated the effect of diurnal variation on the VSC response after running on a treadmill in a randomized controlled trial design. Therefore, the current study aimed to investigate the effect of diurnal variation on the VSC response after running on a treadmill (Figure 2).

2. Research questions

- 2.1 Does the time of day have a significant effect on the VSC response?
- 2.2 Does treadmill running have a significant effect on the VSC response?

3. Objectives of the study

- 3.1 To investigate the effect of time of day on the VSC response after running on a treadmill.
- 3.2. To investigate the effect of treadmill running on the VSC response.

4. Benefits of the study

Results from this study suggest the benefit of the suitable time of day for running on a treadmill and the prevention of the risk of low back pain from spinal loading for healthy people. The results improve the knowledge of effect of time day on the VSC response which was controversial.

5. Scope

To study the effect of diurnal variation on the VSC response in young asymptomatic subjects aged 20-39 years, with normal BMI (18.5 – 24.5 kg/m²). Subjects had to visit the laboratory room on three separate occasions.

The first occasion was for a familiarization with the experimental procedure and equipment for measuring their demographic data.

The second occasion was for performing the test by running on a treadmill 30 minutes (Healey et al., 2008) in the morning.

The last occasion was for performing the test by running on a treadmill for 30 minutes (Healey et al., 2008) in the afternoon.

For the control group, subjects were asked to do a similar protocol to the treadmill running group, except they were asked to do normal daily activity for 41 minutes instead of doing treadmill running.

6. Conceptual framework

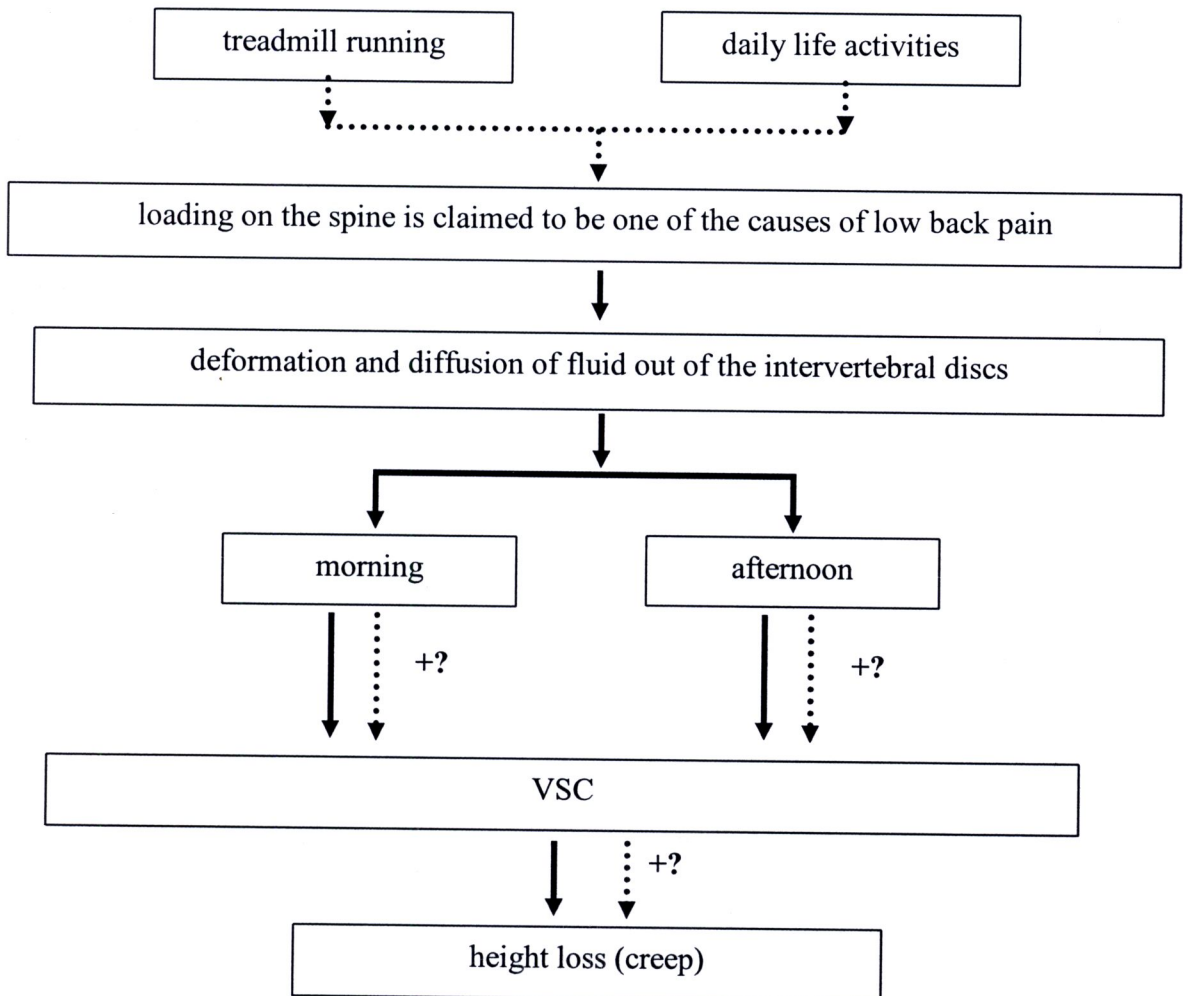


Figure 2 Conceptual framework