Evidence Behind Sit to Stand Workstations

Ahmed Radwan, PT, DPT, Ph.D., Savannah Bernardin BS, SPT, Nicholas Ball AA, BS, SPT,
Julia Primps BS, SPT, Spencer Simmons BS, SPT

Abstract

Increases in sitting behavior within the workplace have led to multiple negative health conditions. Installation of sit to stand workstations can allow users to alternate between the sitting and the standing position, however, there is limited evidence in the literature to support the use of such workstations. The aim of this systematic review was to determine the benefits of sit to stand workstations, both physically and psychologically, on seated workers. Randomized Control Trials that studied the effects of sit to stand workstations were searched, screened and carefully assessed for their methodological quality. The literature search identified 275 potential articles, of these, five articles met the inclusion criteria and were included containing a total of 182 participants. The articles had an average PEDro score of 6/10. This presentation will shed the light on the findings of the current systematic review and the possible evidence behind sit to stand workstations use.

Keywords: Ergonomics, sit to stand workstations, Back Pain

Introduction

On average, employees spend more than half of the workday in the seated position (Pronk, Katz, Lowry, & Payfer, 2012, p.1). Even more, computers are becoming increasingly mainstream in the workplace causing workers to spend as much as 10-11 hours sitting throughout the day (Graves, Murphy, Shepherd, Cabot, & Hopkins, 2015). This sedentary behavior has been linked to office workers acquiring negative health conditions including, obesity, insulin resistance, cardiovascular disease, depression and chronic back and neck pain. (Thorp, Owen, Neuhaus, & Dunstan, 2011, p.208).

Work that is centered on sitting at a desk is linked to higher incidences of musculoskeletal disorders (Robinson, Ciriello & Garabet, 2012). Although the sitting position unloads the muscles of the lower extremity and decreases the demand of antigravity postural muscles, it has been proven that maintaining this position for an extended period of time causes harmful biological effects (Owen et al., 2010). For example BMI, a risk factor for multiple terminal and chronic disease, had been positively correlated with occupational sitting time (van Uffelen et al., 2010). In the seated position, workers are more susceptible to assuming an incorrect posture, which can include, rounded shoulders, flexed elbows and a forward head posture. Bony prominences, such as the ischial tuberosities and olecranon, are put under further stress causing potential skin breakdown. Additionally, in the seated position the circulatory system slows the flow of blood and nerves can become elongated causing inflammation and discomfort (Goodman, Boissonnault, & Fuller, 2009, p.1608).

Increases in pain and health conditions, like the ones listed prior, are positively correlated with increases in health care costs. In particular, individuals who experience back pain are more prone to receive medical imaging for diagnostic purposes. Medical imaging alone is expensive and over time it significantly impacts health care costs (Jarvik et al., 2015). This cost is estimated to be around $1,500.00 per patient (News Now Staff, 2015). Another problem facing the current office worker population is obesity. On average obese individuals spend 42% more on health care when compared to healthy individuals and are more likely to be admitted to hospital emergency rooms for chest-pain (The State of Obesity, 2016).

According to the American Heart Association, heart disease leads all other diagnoses in health care costs, and is projected to rise over the next decade (Mozaffarian et al, 2015). These adverse health conditions, especially when combined, can cause increases in visits to hospitals, primary care physicians, specialty clinicians, and an increase in
Standing for long durations of time may cause some negative health risks as well, such as musculoskeletal pain and discomfort of the lower extremities.

In combining the current knowledge on sustained sitting and standing, it is suggested that office workers receive bouts of both sitting and standing time during working hours (Chau, Daley, Srinivasan, Dunn, Bauman, & Ploeg, 2014). A solution to facilitate movement and contest the associated effects of sitting among the office worker population is a sit to stand work station.

The sit to stand workstation can provide office workers with a versatile desk that can adjust the computer screen and keyboard independently of one another in order to fit each individual’s ergonomic needs. These stations promote comfort, good health and maintain productivity by giving workers the option to alternate between sitting and standing positions.

Installation of new products within the workplace raises a concern in regard to cost. Due to the sit to stand desk’s moveable design, it is reasonable to believe that it costs more than a traditional office desk. However, various customizable styles and accessories could possibly start at a cost of $175.00. Also, The simplest sit to stand workstation offered is an adjustable monitor placed on top of any current desk. By keeping the current desk, the total cost billed to the business or individual can be kept to a minimum.

Current evidence surrounding sit to stand workstations, is limited. At this point research has not identified significant differences in productivity when using a sit to stand workstation versus the traditional desk environment (Hall, Mansfield, Kay, & McConnell, 2015, p.2). There is also evidence of a beneficial reduction in total cholesterol \( (p = 0.049) \) and an improvement in diastolic blood pressure \( (p = 0.293) \), with the use of a sit to stand workstations when compared to the control group (Graves et al., 2015). The same study found no statistical significant difference between the experimental group and the control groups for musculoskeletal discomfort, but there was reduction in pain upper back, neck, and shoulder pain (Graves et al., 2015).

An additional study concluded that back and neck discomfort was significantly improved within a 2 week timeframe (Pronk et al, 2012, p.5). In evaluation of the current evidence, studies looking at sitting with intermittent relief through standing have not yet been performed beyond the acute lab based design, concluding that research needs be done in the current population beyond the acute timeframe (Graves, Murphy, Shepherd, Cabot, & Hopkins, 2015, p.2).

Physical therapists are treating more patients than ever before due to the musculoskeletal issues caused by seated working. All physical therapists have a foundation on ergonomic principles and can use those skills to help prevent injuries in their patients/clients (Hayhurst, 2015). This allows for Physical therapists to educate patients on the importance of appropriate body mechanics and posture in order to eliminate negative health risks.

Ergonomics and posture are modifiable risk factors, meaning that individuals have the ability to alter their risk. By incorporating a properly designed workstation patients can prevent and resolve many of the musculoskeletal disorders caused by seated working (Fabrizio, 2009).

In addition, knowledge on sit to stand workstation health benefits will allow physical therapists to treat more effectively and prevent further damage. With less time spent sitting, reductions in seated work related health issues will occur and will allow for less patient regression between physical therapy sessions (Thorp et al., 2014).

Methods

Evidence surrounding sit to stand workstations and their ability to reduce physical discomfort and improve cognitive ability was searched over multiple databases. The included databases were CINAHL, PubMed, ScienceDirect, and Google Scholar. Keywords including sit to stand workstation, ergonomics, posture, discomfort, and occupation were divided among two search groups.

Four independent reviewers, broken into two groups, used a combination of search terms in screening the databases. The term sit to stand was used in conjunction with either ergonomics and/or posture, or discomfort and/or occupation. Search limits were peer reviewed, randomized controlled trials published in the English language or translation readily available, articles published within the last 5 years, participants’ age range of 18-65 years old, and articles had to focus on the effects of sit to stand workstations on improving workers’ physical/psychological well-being. Articles were excluded if they did not meet the aforementioned criteria.
Initial database search led to a peak number of 275 articles. Titles and abstracts of the search results were screened by two independent raters and in case of discrepancy in their inclusion findings, a third rater interfered or raters’ consensus was utilized. Titles and abstracts were screened down to 15 articles. Full version of the searched articles were acquired and those without a full version were excluded. Upon further review, articles that did not meet the criteria based on the study design were excluded. A total of 5 articles met the inclusion criteria.

Two independent reviewers appraised the articles using both the PEDro scale and the risk of bias. Differences in scores led to a third reviewer appraising the article and collaboration to determine an appropriate score.

**Results and Discussion**

After critiquing the five RCT’s notable trends were identified, including participant demographics, methodological quality of articles, musculoskeletal discomfort, cognitive ability, and productivity.

The mean participant ages for the five articles were 38.4, 38.8, 39.0, 43.2, 46.2, 47.8, and 48.2 with one group having an outlier mean of 22.7. The PEDro scale was used to appraise the strength and quality of the included RCT’s. The PEDro scores given to the five articles included within this systematic review were all rated between 5/10 and 7/10. This trend occurred due to a lack of subject blinding, assessor blinding, therapist blinding and the inability to conceal group allocation.

The Cochrane Collaboration’s Tool for assessing risk of bias (ROB) was used in conjunction with the PEDro to further evaluate the level of bias for each study. The articles were categorized as either unclear or high risk of bias.

Measurements of pain and discomfort were discussed within three of the included articles. The most significant areas of reduced pain or discomfort were musculoskeletal which included the low back, shoulders and neck. Cognition was only assessed in one of the included studies, which concluded that the use of sit to stand workstations does not cause a deficit in cognitive ability. Finally, implementation of sit to stand workstations improved or caused no change in work productivity in two of the studies included in this systematic review.

**Limitations**

In reviewing the included articles there were limitations that influenced the systematic review as a whole. First, the articles were biased due to the inability to blind individuals involved in the studies, secondary to the lab-based design. It is recommended that future researchers develop a study design that takes place within current office environments where blinding can be strongly implemented. A limitation to the design of the systematic review was the small number of included articles. It would be beneficial to have included more than five articles to strengthen the review for the applicability to current practice. To obtain more articles, the inclusion and exclusion criterion could be altered. In particular the time frame could have been broadened beyond the last 5 years in order to capture more articles.

Another limitation of this systematic review was the gender throughout the RCTs. All 5 of the articles had a majority of females participate in the study, hindering the external validity. The disproportionate male to female participant ratio could have occurred for multiple reasons. None of the studies reported having an inclusion or exclusion criterion related to gender.

**Conclusion**

The sit to stand work environment has the ability to decrease musculoskeletal discomfort without compromising productivity and cognitive ability, in the adult office worker population. This systematic review establishes a need for more high quality randomized controlled trials that pay careful attention to methodological quality and risk of bias within the study design.

**References**


**Biographical Sketches**

Ahmed Radwan, PT, DPT, PhD, is Associate Professor in the Doctor of Physical Therapy Program at Utica College in upstate New York. His teaching, research and clinical expertise include biomechanics, ergonomics, and rehabilitation of musculoskeletal pathologies.