

THE SIT-STAND PARADIGM



The Sit-Stand Paradigm: Increasing Workplace Health and Productivity

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■ INTRODUCTION

A 2007 Office Ergonomics White Paper examined the need for movement in the office work environment.¹ Contained within this article was a landmark quote from ergonomist, Stephen Marshall,

“The work environments of tomorrow will not be static, or non-moving. Tomorrow’s work areas will incorporate surfaces that will easily adjust up or down to suit the needs of the individual. This will be true whether they are 4’11” tall or 6’6”... The ability to dramatically change one’s postures, (from sit to stand to sit) should reduce tension and stress, and improve productivity and efficiency. Sitting all day, every day cannot possibly be as good for us. A variety of postures that include both sitting and standing positions have proven to be advantageous when attempting to minimize the risk of work related injuries.”²

Tomorrow is upon us and the body of knowledge explaining the need for movement within the office environment has now become substantial enough that it can no longer be ignored. This White Paper provides a comprehensive perspective on the findings related to workplace movement and provides considerations / guidelines for future planning.



■ TO SIT OR STAND

The amount of time we spend in sedentary postures (sitting) on any given day has grown precipitously over the millennium.³

In fact, the Bureau of Labor Statistics has reported that U.S. adults spend between 8 and 9 hours each day in seated and sedentary positions, mostly at work.⁴ One 2009 study found that the majority of call center operators, both male and female, spent more than 80% of their respective shifts in a seated posture, with many upwards of 95% of their total work shift.⁵ This data is alarming as we know that sitting for extended periods of time, such as during desk and/or computer work, has been linked as a risk factor for musculoskeletal disorders.^{6,7}

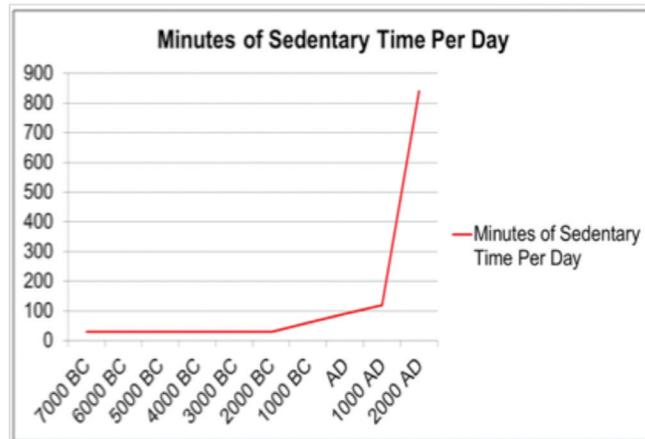


Figure 1: Minutes of Sedentary Time per Day

A more recent growing concern, beyond the noted musculoskeletal risks, is the negative health outcomes associated with extensive sitting at offices and in other occupations. Sedentary behavior, in general, has been correlated with a range of serious health risks, including obesity, hypertension, type II diabetes, metabolic syndrome, deep vein thrombosis, cardiovascular diseases and cancer.^{8,9,10,11} In addition, two recent large population studies found a correlation with sitting time and an increased risk of death.

- An American Cancer Society study of 123,000 adults found that sitting more than 6 hours during leisure time accelerated chances of mortality by 37%.¹²
- A 2009 study published by the American College of Sports Medicine reported that those who sat the most had a 50% increased risk of an early death, regardless of their fitness level.¹³

Since most people between 18 and 65 years of age spend a large part of their daytime hours at work, and since several occupations have been shown to require extensive sitting,¹⁴ sitting in occupational life may contribute significantly to the negative public health effects of “sedentariness”.



Given the adverse health implications of protracted time frames of sitting, it is clear that organizations should consider taking proactive steps to address and remedy the concern. However, with respect to current data, the question remains: Is the solution to occupational “sedentariness” simply doing away with seated work? Not likely, as it turns out, because the alternative – prolonged periods of standing work – comes with its own human health risks, including circulatory issues and musculoskeletal aches and pains.

The literature has identified a multitude of health benefits associated with regular periods of standing versus seated work, such as increased circulation, improved mental clarity, and burning of more calories. Additional research identified healthier metabolic profiles for workers that sat less often throughout the course of a standard workday.¹⁵ However, standing for extended periods can also increase the risk of adverse health impacts: work-related musculoskeletal disorders (MSDs) in the lower body, joint and foot problems, and increased stress to the heart and circulatory system.¹⁶ Essentially, the literature tells us that prolonged standing isn't a sustainable alternative to prolonged sitting.



■ THE SIT-STAND SOLUTION

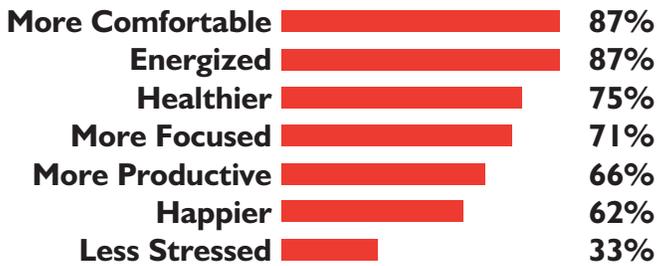
Combating occupational “sedentariness” begins with redesigning our workspace and rethinking how we function within that space.¹⁷ Thus, the first step toward solving the sit or stand dilemma is to realize that it's not an either/or situation; in contrast we need to develop a healthy, balanced approach, combining periods of seated work with periods of standing work, such as through the introduction of a sit-stand paradigm.¹⁸ This innovative sit-stand paradigm is evident in many workplaces today with the presence of sit-stand workstations. These workstations allow the user to easily switch between seated work and standing work, while remaining at the same desk.¹⁹ Alternating between seated work and standing work has been shown to benefit both human health and worker productivity.²⁰ Studies have shown that varying periods of sitting work with periods of standing work helps measurably reduce pain and fatigue complaints in the work environment.²¹



In 2011, The Center for Disease Control and Prevention entered into a community-based case study in Minneapolis, MN. The “Take-a-Stand Project” was designed to reduce prolonged sitting time at work and improve selected health outcomes for employees with sedentary jobs. The findings of the project indicated that installation of sit-stand devices was effective at increasing non-sitting time, reducing upper back and neck pain, and improving mood states.

As reported in the study, “at the end of week 7, the intervention group was asked several questions about specific benefits of alternating between a seated and standing position. Results indicated that 87% felt more comfortable, 87% felt energized, 75% felt healthier, 71% felt more focused, 66% felt more productive, 62% felt happier, and 33% felt less stressed as a result of having the sit-stand device installed at their work stations”. Furthermore, the removal of the sit-stand device largely negated all of the observed improvements within a two week timeframe.²²

**Take-a-Stand Project
(The Center for Disease Control and Prevention, 2011)**



Specific to the 71% of the participants who felt more focused or reported a higher level of cognitive function, there is emerging research which supports this subjective claim. A recent study at the University of Illinois tracked older adults over the period of one year, comparing moderately active adults to their sedentary peers. Unsurprisingly, the more active participants performed better on cognitive tasks such as planning, prioritizing, strategizing and multi-tasking. These findings were correlated to improved connectivity within the circuitry of the brain.²³



In alignment with these results on brain connectivity and circuitry are neurologic findings that demonstrate that standing not only promotes a healthier metabolism but also provides direct conditioning of postural reflexes that may improve balance impairments.²⁴

■ IMPACTS OF PRODUCTIVITY AND ROI

When the sit-stand paradigm was first introduced, many individuals and organizations expressed concerns about a potential reduction in worker productivity. These reservations are largely unfounded. A 2009 study examined whether alternating between sitting and standing work lead to: 1) a reduction in the number of physical discomfort complaints compared to workers that remained seated for prolonged periods; and 2) whether standing during computer work would increase the occurrence of data entry errors. The research team found that discomfort complaints were significantly reduced among workers using the sit-stand paradigm, and that those workers showed no significant loss of data entry efficiency. The study concluded that implementing a sit-stand workstation is an effective workplace health intervention for reducing adverse effects of occupational “sedentariness” without negatively impacting productivity.²⁵



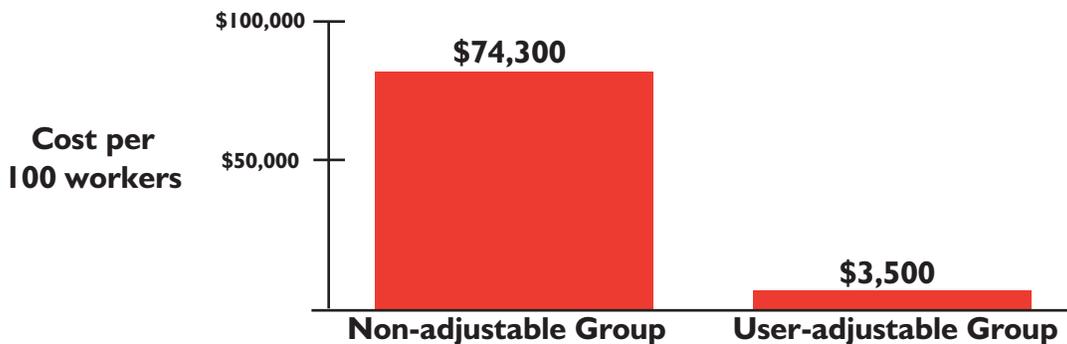
Research performed by Miami University of Ohio demonstrated that intermittent standing increased productivity through a reduction in the parameters of employee work breaks. In essence the employees who intermittently changed their postures took fewer and shorter breaks throughout the day. Individuals who did not alter their position (non-standers) took an average of 47% more breaks throughout the day. In addition, the average duration of their work breaks (non-standers) was 56% longer.²⁶

Finally, organizations constantly wrestle with the cost of large scale implementation of a sit-stand solution for their environment. Many a qualified CFO have justifiably asked the question: What is my Return on Investment? At the end of the day, this question may be the most pertinent question of all the information presented here within. It is critical that organizations can justify their investment, particularly as one moves away from a standard bearer... the seated workstation.

Return On Investment

To those ends, a 2011 Case Study compared the Musculoskeletal Disorders (MSDs) cost data on two similar employee groups: 1) User-adjustable Group and 2) Non-adjustable Group. When comparing all costs (personal and worker compensation costs), they saw a three-fold increase in the cost for the employees in the Non-adjustable Group. When considering only the work-related MSD costs, they experienced a 20X increase in costs for the Non-adjustable Group versus the User-adjustable Group (\$74,300 per 100 workers vs. \$3,500 per 100 workers, respectively).²⁷ The total cost of ownership for the Non-adjustable Group should be considered to be even higher when considering the additional cost for providing ergonomic accommodations within their fixed height environments.

**Musculoskeletal Disorders Cost Data Comparison
(Non-adjustable vs. User-adjustable)**



■ IMPLEMENTATION CONSIDERATIONS / GUIDELINES

The evidence for implementation of sit-stand solutions appears to be compelling when one considers the health and productivity implications coupled with the potential Return on Investment. Given that, the next question which arises is: Where do I begin? What would be considered a rational, yet responsible approach to implementation?

First off, it is important to recognize that not everyone needs a sit-stand solution.

- If one is happy with their current workstation design, experience little or no back discomfort, have a job that requires them to frequently leave their workstation during the course of the day, or have flexibility in their work schedule to leave their workstation when they want, then they may not be a candidate for a sit-stand workstation.
- Individuals with lower extremity orthopedic problems (ankle, knee or hip issues) may not be able to tolerate extended periods of standing.
- Individuals with jobs requiring precision, targeted work, i.e., micro-assembly or intensive graphic design will perform better in a seated posture.



From the perspective of the deployment of a sit-stand solution, it is clear that the rollout strategy can vary widely from organization to organization. In a recent article, Ergonomist Gene Kay, MS, CEA, has succinctly summarized the various rollout options an organization may consider.²⁸

1. **Go Big:** Everyone gets sit-to-stand furniture and coaching and instruction on how/when to use it. This has the highest initial cost but has been shown to produce very good results.
2. **Go Flexible:** Reduce your overall real estate footprint by deploying shared sit-to-stand workstations that two or more workers will use in combination with work from home, alternate shifts and periodic joint work in conference rooms etc. This can significantly reduce your real estate costs and produce excellent results with gains in productivity, retention and engagement.
3. **Go Alternate:** Leave the primary seated station unchanged and identify alternate stand-up areas for other tasks. This could be a small raised portion of the fixed cube for stand-up work (paper work, secondary computer tasks, etc.). Central printers and recycling can encourage users to get up and walk, as can walking to more distant bathrooms and using stairs instead of elevators. This can produce some moderate results with a moderate budget.
4. **Go Small:** If the previous options don't fit your budget or work demands, then only deploy sit-to-stand for those with a qualifying medical need -- look for specific physician recommendations for conditions such as degenerative disc disorder, etc. This produces the least overall Return on Investment, but will help in individual cases and keep you in compliance with ADA regulations.



When it comes to actual use by the individual... "Keep it Simple!" As with most things in life, moderation is the key. The human body responds best to a balance between static and dynamic activity, between activity and recovery, between sitting and standing.

Considerations for staying healthy at a Seated Workstation:

- Stability: make certain your feet are flat on the floor or supported on a viable footrest.
- Clearance / Avoid Barriers: adjust keyboard and mouse height to proper levels.
- Support: learn how to adjust your chair appropriately; specifically for your spine and upper extremities.
- Position: consider monitor height and distance. Remember... recommendations must be based on people, not just angles.
- Add movement into your day... early and often.



Considerations for staying healthy at a Sit-Stand Workstation:

- Remember to alternate postures. Use a timer if it is hard to remember when to change.
- Sit for 1-2 hours, then transition to standing for 1-2 hours; repeat throughout the day.
- Understand ideal keyboard and mouse height, along with position of your monitor. The monitor height will likely need to be re-adjusted when moving between positions.
- Pay attention to how your body is responding, particularly your feet and back, adjust accordingly.
- Consider a fixed-height worksurface with an accompanying stool-height task chair. This will allow you to alternate between sitting and standing without adjusting your worksurface.



■ SUMMARY

The sit-stand paradigm is best approached by striking a balance between the unique work styles and health concerns of employees and the productivity demands of organizations. Organizations must take both into account when crafting a strategy and guidelines for optimizing movement in the workplace.

The findings related to the sit-stand paradigm overwhelmingly support the inclusion of sit-stand solutions in today's workplace. A few simple workplace adjustments can pay dividends for the overall productivity and health of employees as well as the bottom line of a business.



■ REFERENCES

- ¹ Bossen, D, Improved Workplace Performance and Productivity Through Movement: *The Emerging Role of Adjustability*, June 2007
- ² Stephen A. Marshall; <http://www.ergosci.com/newsletter.html#Page3>
- ³ Benden, M, *Sedentary Behaviors, Outcomes and Potential Interventions. Is Obesity an Occupational Disease?* Applied Ergonomics Conference, March 28, 2012
- ⁴ Bureau of Labor Statistics, 2009, Jun 24. News. U.S. Department of Labor
- ⁵ Toomingas et al., Variation Between Seated and Standing/Walking Postures Among Male and Female Call Centre Operators, *BMC Public Health* 2012, 12:154.
- ⁶ Marcus M, Gerr F, Monteilh C, Ortiz DJ, Gentry E, Cohen S, Edwards A, Ensor C, Kleinbaum D: A Prospective Study of Computer Users: II Postural Risk Factors for Musculoskeletal Symptoms and Disorders. *Am J Ind Med* 2002, 41:236-49.
- ⁷ Husemann, B., Von Mach, C., Borsotto, D., Zepf, K., Scharnbacher, J., 2009. Comparisons of Musculoskeletal Complaints and Data Entry Between a Sitting and a Sit-stand Workstation Paradigm. *Hum. Factors* 51, 310e320.
- ⁸ van Uffelen J, Wong J, Chau J, van der Ploeg H, Riphagen I, Gilson N, Burton N, Healy G, Thorp A, Clark B, Gardiner P, Dunstan D, Bauman A, Owen N, Brown W: Occupational Sitting and Health Risks a Systematic Review. *Am J Prev Med* 2010, 39:379-388.
- ⁹ Owen N, Healy GN, Matthews CE, Dunstan DW: Too Much Sitting: The Population Health Science of Sedentary Behavior. *Exerc Sports Sci Rev* 2010, 38:105-113.
- ¹⁰ Moradi T, Gridley G, Björk J, Dosemeci M, Berkel HJ, Lemeshow S: Occupational Physical Activity and Risk Factor for Cancer of the Colon and Rectum in Sweden Among Men and Women by Anatomic Subsite. *Eur J Cancer Prev* 2008, 17:201-208.
- ¹¹ Healy GN, Matthews CE, Dunstan DW, Winkler EAH, Owen N: Sedentary Time and Cardio-metabolic Biomarkers in US Adults: NHANES 2003-06. *Eur Heart J* 2011, 32:590-597.
- ¹² Patel et al., Leisure Time Spent Sitting in Relation to Total Mortality in a Prospective Cohort of US Adults, *Am J Epidemiology* 2010 172(4).
- ¹³ Katzmarzyk P, Church T, Craig C, Bouchard C: Sitting Time and Mortality from all Causes, Cardiovascular Disease, and Cancer. *Med Sci Sports Exerc* 2009, 41:998-1005.
- ¹⁴ Jans MP, Proper KI, Hildebrandt VH: Sedentary Behavior in Dutch Workers. Differences Between Occupations and Business Sectors. *Am J Prev Med* 2007, 33:450-454.
- ¹⁵ Healy, G.N., Dunstan, D., Salmon, J., Cerin, E., Shaw, J.E., Zimmet, P.Z., Owen, N., 2008. Breaks in Sedentary time. Beneficial Associations with Metabolic Risk. *Diabetes Care* 31, 661e666.
- ¹⁶ Nelson-Wong, E., Howarth, S., & Callaghan, J. (2010). Acute Biomechanical Responses to a Prolonged Standing Exposure in a Simulated Occupational Setting. *Ergonomics*, 53(9), 1117-1128.
- ¹⁷ Chau, J.Y., van der Ploeg, H.P., van Uffelen, J., Wong, J., Riphagen, I., Healy, G., et al., 2010. Are Workplace Interventions to Reduce Sitting Effective? A Systematic Review. *Prev. Med.* 51, 352e356.

- ¹⁸ Straker, L., Abbott, R. A., Heiden, M., Mathiassen, S. E., & Toomingas, A. (2012). Sit-Stand Desks in Call Centers: Associations of Use and Ergonomics Awareness with Sedentary Behavior. *Applied Ergonomics*.
- ¹⁹ Owen, N., Sugiyama, T., Eakin, E., Gardiner, P., Tremblay, M.S., Sallis, J.F., 2011. Adults Sedentary Behavior, Determinants and Interventions. *Am. J. Prev. Med.* 41, 189e196.
- ²⁰ Straker, L., Abbott, R. A., Heiden, M., Mathiassen, S. E., & Toomingas, A. (2012). Sit-Stand Desks in Call Centers: Associations of Use and Ergonomics Awareness with Sedentary Behavior. *Applied Ergonomics*.
- ²¹ Roelofs, A., Straker, L., 2002. The Experience of Musculoskeletal Discomfort Amongst Bank Tellers Who Just Sit, Just Stand or Sit and Stand at Work. *Ergon. SA* 14, 11e29.
- ²² Pronk NP, Katz AS, Lowry M, Payfer JR. Reducing Occupational Sitting Time and Improving Worker Health: The Take-a-Stand Project, 2011. *Prev Chronic Dis* 2012;9:110323
- ²³ Voss et al., Plasticity of Brain Networks in a Randomized Intervention Trial of Exercise Training in Older Adults. *Front. Aging Neurosci.*, 26 August 2010
- ²⁴ Bohnen N., Muller M., Performing Routine Activities of Daily Living at a Stand-up Table: A Low-Intensity Auto-Exercise Pilot Project to Improve Balance. University of Michigan Medical School, Functional Neuroimaging, Cognitive and Mobility Lab
- ²⁵ Husemann, B., Von Mach, C., Borsotto, D., Zepf, K., Scharnbacher, J., 2009. Comparisons of Musculoskeletal Complaints and Data Entry between a Sitting and a Sit-Stand Workstation Paradigm. *Hum. Factors* 51, 310e320.
- ²⁶ Dainoff, M. J., "The Effects of Ergonomic Work Tools on Productivity in Today's Automated Workstation Design", Center of Ergonomic Research, Miami University (Oxford, Ohio).
- ²⁷ Kay G. (2012, April 4). Evidence: Investing in Adjustable Workstations Produces a Health ROI. *Ergoweb*[®]. Retrieved July 11, 2012, from <http://www.ergoweb.com/news/detail.cfm?id=2618>
- ²⁸ Kay G. (2013, February). Sit vs. Stand: Who Benefits from Sit-to-Stand Workstations? *Ergoweb*[®]. Retrieved July 12, 2012, from <http://www.ergoweb.com/news/detail.cfm?id=2702>



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