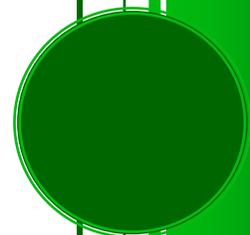


HEIGHT ADJUSTABLE PLATFORMS



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Height Adjustable Workstations Allowing for Alternating Between Sitting and Standing

We have all heard it; sitting is the new smoking. Being sedentary shortens our lifespan and can create long-term negative health effects. These negative health outcomes include all-cause mortality (van der Ploeg, Chey, Korda, Banks, & Bauman, 2012) disabilities such as obesity, diabetes, and cardiovascular disease (MacEwen, MacDonald, & Burr, 2015; Wilmot et al., 2012) as well as musculoskeletal disorders (MSD's) of the hand, wrist, neck, upper and lower back (Ekman, Andersson, Hagberg, & Heljm, 2000; Gerr et al., 2002; Korhenon et al., 2003; Rocha et al., 2005; Wahlström, 2005; Wahlström, Hagberg, Toomingas, & Tornqvist, 2004).

However, Dr. Jack Dennerlein, Adjunct Professor of Ergonomics and Safety in the School of Public Health at Harvard University has said, *"you have to remember standing is the old smoking."* Ultimately, standing is not the answer either. Detriments of prolonged standing can include malfunction of venous valves, venous insufficiency, etc. (Krijnen, de Boer, Ader, & Bruynzeel, 1997) have a detrimental effect on arterial blood flow (Reinhardt et al., 2000) and increase the risk of carotid atherosclerosis (3-9 times) Krause et al. (2000).

Neither sitting nor standing for long periods are good for the body. The key with any height adjustable workstation is movement. Unfortunately, too much focus has been placed on standing more and sitting less, when the mixture of the two postures is most important. Ideally, when using a sit/stand height adjustable workstation, users should adjust and vary postures every 30-60 minutes or so and avoid long durations of either sitting *or* standing (Callaghan, 2015). Remember, the best posture is the next posture.

Even if you have an adjustable workstation, it does not mean you are free from all ergonomic risk. Dr. Hedge at Cornell University stated, "So called ergonomic products do not guarantee healthy work posture!" The correct height of the table, height and position of the keyboard and mouse, monitor(s), etc., are crucial regardless of whether you are sitting or standing. In a study in 2016 by Lin, Catalano and Dennerlein it was found that study participants adjusted the placement of desktop height, monitor height/tilt and the keyboard distance when comparing sitting to standing. Ultimately, placement of the monitor, keyboard and desktop height need to move when adjusting between sitting and standing. Simply raising the desktop height is not enough. Other parts of the workstation need to be adjustable as well and this fact seems to be an afterthought.

Although the ability to stand and work on the computer can be beneficial, making modifications to the workstation to allow for this should not introduce ergonomic hazards into the workstation. This can unfortunately be a common problem given the highly available and relatively inexpensive 'platforms' which are attached to or sit on top of an existing table or work surface. Although desktop 'platforms'

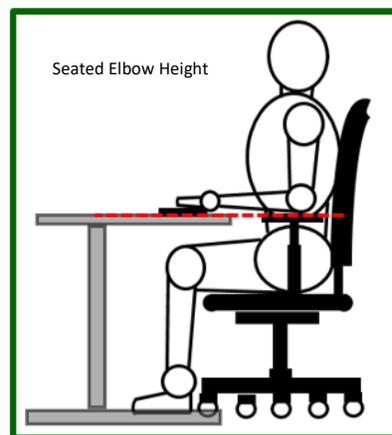
Although height adjustable, 'platforms' which sit on the desktop are too high for **~95% of users**. Forcing the work too high increases likelihood for awkward postures which increases the risk for injury.

may be height adjustable, there are significant detriments introduced into the workstation which can expose the user to ergonomic hazards and increase the risk for injury. One of the main issues with platforms that are placed on a fixed work surface are that these platforms do not adjust appropriately below a standard work surface height. This is crucial for a majority of the population.

The standard work surface height, which was designed for the 95th-99th percentile male (~6'2 – 6'4) is approximately 29-31 inches high. Much like the design

of a doorway, which was designed to allow everyone to fit underneath or inside the frame without hitting their head, this work surface height allows for a majority of the population to fit underneath the surface without encountering leg obstructions (knees/thighs bumping the work surface). Although this height allows for most users to fit underneath the surface, it does not allow for an ideal working elbow height for approximately 95% of workers.

To further illustrate, think of the work surface height related to shoe size. Much like a shoe should fit the foot, the work surface, desk or table should 'fit' the body. For an ideal 'fit', the height of the work surface (i.e. height of the keyboard and mouse) should be located at or slightly below resting elbow height (see picture at right). When the work is designed to be performed at elbow height, the risk for shoulder, neck and back strain and fatigue due to awkward postures is minimized.



Regardless of the type of height adjustable work surface option used, if the surface does not adjust properly, (below the standard 29-31 inch work surface height), it will force the work too high. This will be the case for anyone shorter than approximately 6'2" tall (or approximately 95% of the working population).

If a height adjustable 'platform' is added to a standard 29-31 inch 'fixed height' work surface and the platform does not allow for adjustment below work surface height, the keyboard and mouse are raised even higher (~32-34 inches). When sitting, this immediately exposes the user to awkward postures and other ergonomic risk factors which can over time lead to injury.

To further illustrate using the shoe size example, using a standard 'fixed' work surface height of ~29 inches is like wearing a 12-14 size shoe and expecting it to 'fit' properly. Of course, not many people correctly fit into this size of shoe which is far too big for the foot. Now, think of wearing this size of shoe while running marathon. Although a person may be able to complete the marathon, it is likely that not only will their performance suffer but so will their feet, especially over the long term.

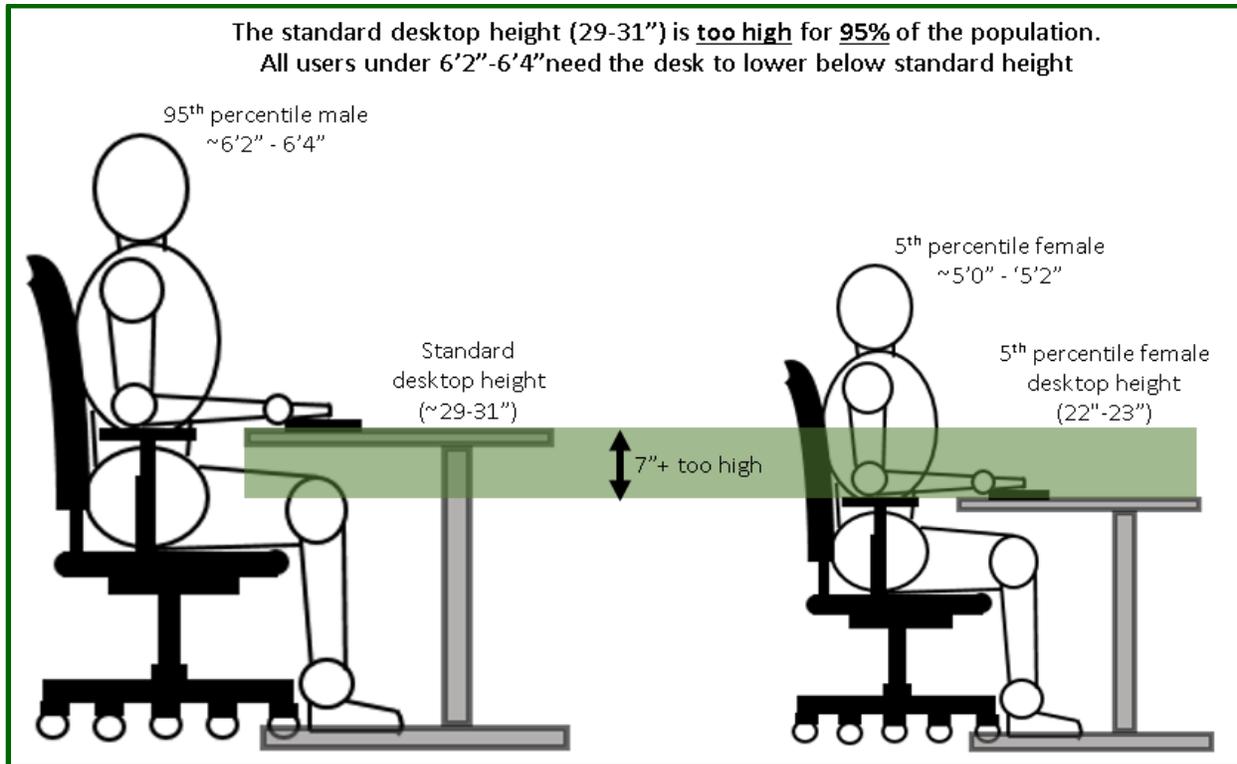
By introducing a 'platform' which sits on an existing work surface, it forces the work surface (height of the keyboard and mouse) another few inches higher. Now, the user is wearing an even larger shoe size of ~13-15.

Platforms that sit on top of a standard fixed work surface height simply will not 'fit' most users correctly. If used, risk for injury and exposure to ergonomic risk increases. Height adjustable options need to lower below 29 inches for ~95% of users, not higher. An ideal height adjustment range which will allow for a majority of workers to adjust the height to properly 'fit' is ~22-48 inches. If this specification is met, a majority of the work force will be able to adjust the work surface height to allow for the proper fit.

Desktop Height Illustration

The below illustration shows the difference in work surface height for a 95th percentile male (~6'2") compared to a 5th percentile female (~5'1"). This ~7-inch difference is significant and commonly leads to awkward postures. These detrimental awkward postures are further discussed below.

Even for an average 5'8" male (not shown) the work surface is ~4 inches too high. (An ideal work surface height for 5'8" male is approximately 26-27 inches). We might think that the difference is negligible but again, much like wearing a shoe that is 4 sizes too big, over the long term, it is likely the foot will be negatively affected.



The Computer Hunch

Because the standard 29-31 inch work surface forces the keyboard and mouse too high, very common awkward postures are assumed in the neck, shoulders, elbows and upper back. As illustrated in the picture at right, leaning forward and 'hunching' over the work surface increases the lumbar disc pressure by 85% in comparison to standing in a relaxed posture (Wilke, H., Neef, P., Caimi, M., et al., 1993). Along with the computer hunch, the shoulders are also affected and often round forward, elevate and or abduct (swing out to the side). These awkward postures increase tension and fatigue on the shoulders and upper back which can lead to fatigue and discomfort and over time, can lead to injury.



Picture Source: Humanscale Ergonomics

Sitting at a computer and hunching over the desktop increases back pressure by 85% compared to standing upright.

If any components of the workstation are neglected, the risk for musculoskeletal disorders can increase. Studies have shown that musculoskeletal disorders seen in computer users (i.e. tendonitis, carpal tunnel, neck strain, etc.) can be correlated to user posture, force, repetitive work, poor working technique and the duration of computer work. (Wahlstrom, 2005).

Standing Height

Work surface height is not only important when sitting. If the work surface does not adjust sufficiently when standing, similar ergonomic hazards can be introduced and can be equally damaging to the body. The increase in ergonomic risk and exposure to ergonomic hazards are commonly seen with taller individuals because the work surface does not rise adequately. Height adjustable 'platforms' may not adjust high enough to 'fit' taller users due to a limited height adjustment range. This will increase ergonomic injury risk due to a work surface which is too low. These ergonomic risk factors include extension of the elbow and wrist, rounding of the shoulders, and back flexion (leaning forward at the waist). Back to the same shoe example, the taller user is being asked to wear a size 8-9 shoe when a size 12-14 is needed. Again, improper fit.

Due to these and other several other factors, 'platforms' which sit on an existing desktop are not recommended as they are not ergonomic options, do not provide a proper fit for ~90-95% of the working population and expose the user to ergonomic hazards which increase the risk for injury.

An electric height adjustable table that adjusts from ~22-48 inches ensures that the work surface has the capability to adjust to properly fit a majority of the population's varying size and stature. A table which meets ergonomic design criteria will properly 'fit' employees regardless of their height, weight, gender, etc. An electric height adjustable table which meets ergonomic design criteria should be implemented as there are no significant limitations.



Picture Source: Herman Miller

Responsibility then belongs to the user to ensure proper adjustments are made to the work surface height and other components of the workstation in order to reduce the exposure to ergonomic hazards, minimize injury risks and decrease the likelihood for injury. However, it is not enough to simply provide adjustable workstations and expect users to adjust them correctly. Training is needed. The effectiveness of height adjustable workstations is improved with proper ergonomics training (Robertson, Ciriello, & Barabet, 2013). In addition, new technology, which is built into the height adjustable workstation itself, may help with educating users regarding the proper height adjustment and appropriate workstation setup.

OSHA, Viewing Height and Distance

As mentioned above, the monitor height and tilt need to adjust relative to desk height when sitting or standing. Proper monitor adjustment will help prevent issues such as eye strain, computer vision syndrome, awkward neck postures and head and neck discomfort. OSHA recommends a monitor viewing distance of ~20-40 from the eyes when on the computer. Many desktop 'platforms' will not allow for this distance because of the lack of space on the surface of the platform or simply because the monitors cannot at all be adjusted in depth because they are affixed to an 'arm'. For this reason, these 'platforms' do not meet OSHA guidelines and again are not recommended.

Along with viewing distance, viewing height may also be an issue. As mentioned above, because certain 'platforms' force monitors to attach to an 'arm' or 'pole', many have a limited height range adjustment. If a user needs a slightly higher or lower monitor height, they simply cannot make this adjustment with certain platforms. This is especially important if a user has corrective lenses (i.e. multifocal lenses).

Again, although height adjustable 'platforms' allow for sitting and standing, these are not recommended because of the issues mentioned within this document.

Cost

Although historically the cost of a height adjustable table was thought of as very expensive, height adjustable tables today may cost **less than** the average priced ergonomic chair. For additional information and a comparison between various height adjustable options, go to the below website.

[Comparison Between Height Adjustable Workstations](#)

Certainly, the cost of a height adjustable 'platform' can be relatively inexpensive in comparison to other options; however, what are you sacrificing by adding this less than ideal option? Sure, standing is feasible, and the cost may slightly less but will you able to adjust it properly to 'fit'? Will you expose yourself to awkward postures (hands, wrists, elbows, shoulders, neck)? Are you willing to risk an injury? Is this lack of adjustment worth the money savings? Is standing all that necessary?

According to Dunstan et al. (2012) 1-2 minutes of movement per hour mitigates the prolonged health effects of prolonged sitting. Additionally, at the National Ergonomics Conference and Exposition in

November 2015, Dr. Joan Vernikos (former Director of Life Sciences at NASA), simply said to stand up often. “Standing up often, at least 30 times a day, is a powerful antidote to sitting.” Dr. Vernikos also mentioned that it is the frequency or number of times one stands, not the duration, that is important. Furthermore, if you cannot stand, and sitting time remains the same, incorporate more frequent movements (instead of sitting for long periods and taking breaks) as this has been shown to have a beneficial biological impact (Owen, Healy, Matthews, & Dunstan, 2010).

Rather than increasing the risk for injury with the use of a ‘platform’ that does not properly fit the body, stand up frequently. Get a refill of water or coffee, walk to the printer, go talk to a co-worker instead of sending that email, get up to stretch, get a telephone headset and stand while taking phone calls, arrange walking meetings, park further away from your building, take the stairs, or leave your office for lunch. Remember, movement throughout the day is crucial.

Additional Information Height Adjustable Workstations

- [Cornell University – Sit Stand](#)
- [Cornell University – Sit Stand Programs](#)
- [Workrite Ergonomics The Facts About Standing Desks White Paper](#)

Ergonomics Program Resources

- [CSU Ergonomics Program Home Webpage](#)
- [Ergonomic Evaluation Request](#)
- [Ergo Lab & Equipment Trials](#)
- [Ergonomics Matching Funds Program](#)
- [Office Ergonomics Furniture Design Specifications](#)

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