Why use a Sit-to-Stand Workstation?

Office workers have been found to sit for long periods both at work and during leisure time, on work and non-work days often for prolonged unbroken bouts. Increased time spent in sitting has negative metabolic, cardiovascular and musculoskeletal health impacts, increasing the risk of premature chronic disease and mortality and work related musculoskeletal disorders (WMSDs) (Chau et al., 2014; Chau et al., 2013; Parry, 2013; Smith et al., 2015). There has been an increase in frequency of WMSDs with the development of computer technology, most commonly in the neck, upper limb and back, across the developed and developing world (Mani, Provident, & Eckel, 2016). Therefore, the importance of preventing these WMSDs is critical to improving community health outcomes, disease and mortality prevalence and part of our role as physiotherapists. Sit-stand workstations are seen by many as an intervention providing physical variance to work postures and therefore may be able to improve health-related outcomes such as reduced WMSDs and improved cardio-metabolic parameters (Karakolis, Barrett, & Callaghan, 2016).

Evidence?

Two systematic reviews were found for the effects of SSW in an office population identifying methodological shortcomings in most SSW studies to date (Shrestha et al., 2015; Tew, Posso, Arundel, & McDaid, 2015). They concluded that:

- the evidence was of very-low to low quality for short-to-medium term reductions in sitting time without adverse effects on musculoskeletal symptoms (MS) or work productivity and no evidence in the long-term.
- it remains unclear if standing can repair the harms of sitting because there is minimal additional energy expenditure with standing and inconsistent evidence regarding metabolic parameters.

Since 2015 several studies have attempted to gain further evidence on WMSDs with SSWs however they too have significant methodological weaknesses (including a failure to blind subjects, therapists and assessors and objectively measure standing and sitting times).

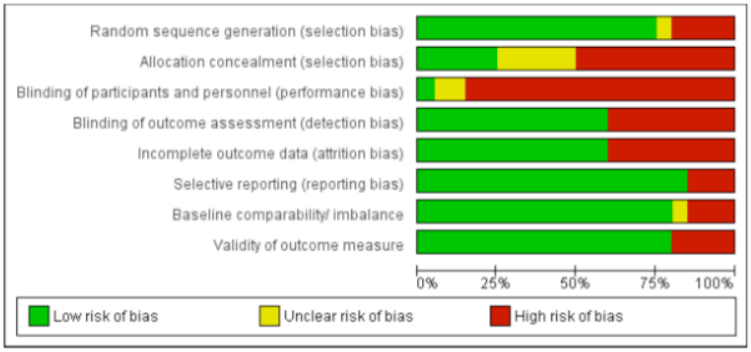

Figure 1
Risk of bias items as percentages across all included reviewed studies (Shrestha, Ijaz, Kukkonen-Harjula, Kumar, & Nwankwo. 2015).

The premise that increased standing time was beneficial has been challenged by research highlighting the presence of musculoskeletal symptoms with prolonged standing (Andersen, Haahr, & Frost, 2007; Lin, Barbir, & Dennerlein, 2017). A variety of schedules have been cited throughout the literature with inconsistent and conflicting findings.

Conclusion

Although sit-stand desks are popular, their potential health benefits are very uncertain. In general, it appears that SSWs may reduce discomfort in the shoulders and upper back or neck when standing and the lower back and lower extremities when sitting. With respect to scheduling, it would seem that the ability to avoid prolonged sitting or standing is perhaps the most important factor in reducing WMSDs enabling some short-term recovery of discomfort. The movement between sitting and standing may be the most important factor for improving cardio-metabolic parameters and energy expenditure although this requires verification as it extends beyond the scope of this review.

Table 2 - *Cardiometabolic and musculoskeletal outcomes of SSW (Graves, Murphy, Shepherd, Cabot, & Hopkins, 2015): An Example of the Literature*

	Intervention		Control		Adjusted change 0 to 8 week (95% CI)[b]	Probability (%) the true effect is beneficial / trivial / harmful	Qualitative inference
	Baseline[a]	8 week[a]	Baseline[a]	8 week[a]			
Vascular (n = 24 I, 19C)							
FMD (%)	5.98 (2.32)	7.13 (2.42)	5.88 (2.29)	6.13 (2.64)	0.97 (-0.55 to 2.50)	75/22/3	Benefit likely
cIMT (mm)	0.62 (0.07)	0.61 (0,07)	0.58 (0.08)	0.57 (0.08)	0.00 (-0.03 to 0.02)	13/84/3	Likely trivial
Systolic BP (mmHg)	119.1 (13.8)	117.1 (12.5)	117.9 (12.1)	117.3 (9.0)	-1.6 (-7.0 to 3.7)	22/71/7	Unclear
Diastolic BP (mmHg)	73.5 (7.6)	68.9 (8.5)	71.8 (10.7)	70.5 (9.5)	-2.5 (-7.2 to 2.2)	62/35/3	Benefit possible
Blood (n = 20 I, 17 C)							
Glucose (mmol/L)	5.3 (0.79)	4.59 (0.84)	4.85 (0.62)	4.49 (0.55)	-0.09 (-0.56 to 0.39)	37/49/14	Unclear
Triglycerides (mmol/L)	1.65 (0.70)	1.61 (0.74)	1.61 (0.64)	1.65 (0.73)	0.11 (-0.23 to 0.45)	6/55/39	Unclear
Cholesterol (mmol/L)	4.45 (0.98)	3.79 (1.05)	3.94 (0.86)	3.78 (0.74)	-0.4 (-0.79 to -0.003)*	82/18/0	Benefit likely
Musculoskeletal discomfort/pain[c] (n = 25 I, 21 C)							
Lower back	2.5 (2.2)	1.8 (2.0)	2.0 (2.0)	1.7 (1.8)	-0.2 (-1.0 to 0.7)	35/50/15	Unclear
Upper back	1.9 (2.3)	1.1 (1.7)	1.2 (1.5)	1.6 (2.3)	-0.9 (-1.9 to 0.2)	83/16/1	Benefit likely
Neck and shoulder	2.6 (2.5)	1.9 (2.4)	2.1 (2.0)	2.2 (2.4)	-0.6 (-1.5 to 0.2)	63/36/1	Benefit possible

I intervention group, *C* control group, *FMD* flow mediated dilation, *cIMT* carotid intima-media thickness, *BP* blood pressure

a Baseline and 8-weeks values are unadjusted mean (SD)

b Change scores and 95% CIs are the differences between groups (relative to control) after adjustment by ANCOVA for the baseline value. Tricglycerides ANCOVA additionally adjusted for marital status, time at current workplace and job category

c Values denote the severity of discomfort or pain from 0 (No discomfort) to 10 (Extremely uncomfortable)

* significant ($p = 0.049$)

References

Andersen, J. H., Haahr, J. P., & Frost, P. (2007). Risk factors for more severe regional musculoskeletal symptoms: A two‐year prospective study of a general working population. *Arthritis & Rheumatology, 56*(4), 1355-1364.

Chau, J. Y., Daley, M., Srinivasan, A., Dunn, S., Bauman, A. E., & van der Ploeg, H. P. (2014). Desk-based workers' perspectives on using sit-stand workstations: a qualitative analysis of the Stand@Work study. *BMC Public Health, 14*(1), 752. doi:10.1186/1471-2458-14-752

Chau, J. Y., Grunseit, A. C., Chey, T., Stamatakis, E., Brown, W. J., Matthews, C. E., Bauman, A.E., & van der Ploeg, H. P. (2013). Daily sitting time and all-cause mortality: a meta-analysis. *PLOS ONE, 8*(11), e80000. doi:10.1371/journal.pone.0080000

Graves, L. E. F., Murphy, R. C., Shepherd, S. O., Cabot, J., & Hopkins, N. D. (2015). Evaluation of sit-stand workstations in an office setting: a randomised controlled trial. *BMC Public Health, 15*(1), 1145. doi:10.1186/s12889-015-2469-8

Karakolis, T., Barrett, J., & Callaghan, J. P. (2016). A comparison of trunk biomechanics, musculoskeletal discomfort and productivity during simulated sit-stand office work. *Ergonomics, 59*(10), 1275-1287. doi:10.1080/00140139.2016.1146343

Lin, M. Y., Barbir, A., & Dennerlein, J. T. (2017). Evaluating biomechanics of user-selected sitting and standing computer workstation. *Applied Ergonomics, 65*, 382-388. doi:10.1016/j.apergo.2017.04.006

Mani, K., Provident, I., & Eckel, E. (2016). Evidence-based ergonomics education:Promoting risk factor awareness among office computer workers. *Work-A Journal of Prevention Assessment & Rehabilitation, 55*(4), 913-922. doi:10.3233/WOR-162457

Parry, S. S., L. (2013). The contribution of office work to sedentary behaviour associated risk. *BMC Public Health, 2013*(13), 10.

Shrestha, N., Ijaz, S., Kukkonen-Harjula, K. T., Kumar, S., & Nwankwo, C. P. (2015). Workplace interventions for reducing sitting at work. *Cochrane database of Systematic Reviews, 1*(1), CD010912. doi:10.1002/14651858.CD010912.pub2

Smith, L., Hamer, M., Ucci, M., Marmot, A., Gardner, B., Sawyer, A., Wardle, J., & Fisher, A. (2015). Weekday and weekend patterns of objectively measured sitting, standing, and stepping in a sample of office-based workers: the active buildings study. *BMC Public Health, 15*(1), 9-9. doi:10.1186/s12889-014-1338-1

Tew, G. A., Posso, M. C., Arundel, C. E., & McDaid, C. M. (2015). Systematic review: height-adjustable workstations to reduce sedentary behaviour in office-based workers. *Occupational Medicine-Oxford, 65*(5), 357-366. doi:10.1093/occmed/kqv044