Consumables & Instruments

WHITE PAPER

Safety, Sample Integrity and Throughput with Semi-Automated Sample Tube Decapping

AZENTA
LIFE SCIENCES

azenta.com

Introduction

Downtime due to absence can have a clear link to lab throughput and potentially increase the demands on already high workloads. A common cause of lost work days is Carpal Tunnel Syndrome (CTS), which has seen a 500% increase over the past 2 decades leading to more lost workdays than any other workplace injury.[1]

The Repetitive Strain Injury (RSI) Carpel Tunnel Syndrome (CTS) has been described as an occupational disease due to association with repetitive work and physical load factors. Working conditions and type of work have been established as more important than physical characteristics in determining the severity of neuro-compression and return to work is more strongly influenced by working conditions rather than clinical factors or physical characteristics.[1,3,4]

Highly repetitive manual tasks such as capping and decapping sample tubes could be a potential cause of CTS in the workplace, lead to bottlenecks that could impact throughput or even cross contamination through mistakes. Therefore, manual processes may have a detrimental effect on sample integrity during key workflows used in biobanking or compound management.

Risk Factors for CTS

Occupation hand uses that are considered ergonomic risk factors include:

- Highly repetitive wrist movement
- High pinch force

Repetition is the most recognised risk factor and is defined by the frequency of the task or the proportion of time spent on repetitive work.

High repetition is considered as a job requiring awkward wrist movement of less than 30 seconds each time, or more than 50% of the time spent performing the same task involving awkward wrist movement.

Epidemiological studies have also considered high hand/finger grip force as a co-risk factor for CTS, based on the weight of the tool used or the impact on forearm muscle load.[1,2,3,4] Risk factors have shown to be cumulative based on the number of physical load factors involved.[4] Manually de-capping and then re-capping of a rack of 96 tubes requires ~384 twisting movements over approximately 14 minutes.

Impact of Manual Processes on Throughput

Figure 1 shows a direct comparison of decapping and capping a full rack of 96 Sample Tubes in SBS Format, which are widely used in a biobanking and compound management workflows both manually (using a manual single tube decapper) and semi-automatically (using the Semi-Automated Screw Cap Decapper, Single Channel). The time taken to manually de-cap and re-cap a full rack of 96 sample tubes is 14:10 on average, conversely the time taken with a Semi-Automated decapper is 3:26 on average. Extrapolating this based on a conservative throughput of 20 racks per day, using a manual process would take 4:45hrs of decapping & recapping alone versus 1:10hrs with a manual process, saving 3:35hrs per day. Further extrapolated over a year, using a semi-automated decapper could save upto 117 days (based on an 8hr working day).

Results

Full Rack De-Cap & Re-Cap Semi-Automated vs. Manual

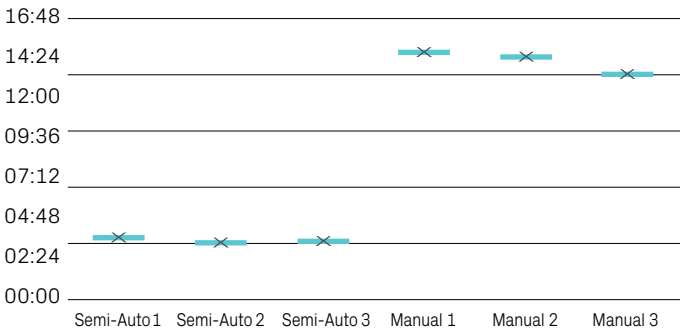

Figure 1

Epidemiological Evidence

Population Studies have shown a higher incidence of CTS in women than men. Gender specific analyses have demonstrated a statistically significant correlation with work tasks involving vibrating tools in men, and work tasks requiring high force handgrip or repetitive movements of the hand or wrist in women. [4,5,6,7]

Work tasks requiring repetitive movements of the hand or wrist and handgrip with high forces were shown to be related to a higher incidence of surgical intervention and prevalence of CTS increased with increasing duration of exposure.

The elevated risk of CTS for both manual load handling and repetitive hand movements has been shown to persist after retirement suggesting long-term forceful or repetitive hand activities may have long lasting effects and cause irreversible damage to the flexor synovial cells and median nerve.[8]

Conclusions

Sample integrity can be risked through highly repetitive manual processes such as manual decapping and capping, through either cross contamination due to human error or over exposure to open lab environments. This highly manual process can also cause bottlenecks and take up a significant amount of time when compared to a semiautomated process.

The risk of CTS, associated human error and lost time due to a highly manual process can be mitigated through the use of a semiautomated decapper, such as the Semi-Automated Screw Cap Decapper from Azenta Life Sciences. Using the Semi-Automated Screw Cap Decapper clearly reduces the amount of manual work and therefore could reduce the risk of RSIs including CTS, it also could save up to 117 work days per year, based on a throughput of 20 racks a day.

References:

1. Kao, YS. (2003) “Carpel Tunnel Syndrome As an Occupational Disease”, JABFP, 16, (6), pp 533-542
2. Moore, JS., Garg, A. (1994) “ Upper extremity disorders is a pork processing plant: relationships between job risk factors and morbidity”, Am Ind Hyg Ass , 55, pp703-715
3. De Kesel, R., Donceel, P., De Smet, L. (2008). “ Factors influencing return to work after surgical treatment for carpel tunnel syndrome”, Occupational Medicine, 58, pp187-190
4. Shiri, R., Miranda, H., Heliovaara, M., Viikari-Juntura, E. (2009), “Physical work load factors and carpel tunnel syndrome: a populationbased study” Occup Environ Med, 66, pp368-373
5. Astroshi, I., Gummeson, C., Johnsson, R et al (1999) “ Prevalence of carpel tunnel syndrome in a general population”, JAMA 282, pp153-158
6. Bland, JD, Rudolfer, SM, (2003) “ Clinical surveillance of carpel tunnel syndrome in two areas of the United Kingdon, 1991-2000”, J Neurol Neurosurg Pshyciatry 74, pp1674-1679
7. Mondelli, M, Giannini, F., Giacchi, M. (2002) “ Carpel tunnel syndrome in a general population”, Neurology 58, pp289-94
8. Rempel, DM, Diao, E., (2004) “ Entrapment neuropathies: pathophysiology and pathogenesis”, J Electromyogr Kinesiol, 14, pp71-75

AZENTA
LIFE SCIENCES

azenta.com