

### Abstract

Different workplaces and tasks have high complexities in terms of interaction between humans and their working environment. This challenge has created problems for both an employer and employees. During World War II, the improvement for safety and performance of military systems became a real concern. Systems such as aircrafts, naval ships and large-scale weapons required attention. "Designers recognized the importance of reflecting the characteristics of the operator in the equipment they designed" (American Psychological Association, n.d.). The continuation of research expanded into commercial sectors with consumer products, office settings and space systems. The current global ergonomics is concerned with both improving the design of products or systems and improving conditions in the workplace.

The primary objective of ergonomics is to optimize the functioning of any system or process by adapting it to human capacities and needs. Adjusting the job to fit the worker can help reduce ergonomic stress and eliminate many potential musculoskeletal disorders (MSDs). The most prominent examples of musculoskeletal injuries include tennis elbow (a soreness of a tendon in the elbow) and carpal tunnel syndrome (condition affecting both the hand and wrist).

### Ergonomic Assessment of a Molding Department

The purpose of this study is to assess the ergonomic hazards for the molding department at DSM Biomedical. The repetitive nature of these tasks caused this ergonomic assessment along with the previous injury. The Rapid Entire Body Assessment (REBA), Rapid Upper Limb Assessment (RULA) and Rodgers Muscle Fatigue Analysis were used to determine what level of risk these activities pose.

The processes that were evaluated were THM7 and ST-20. These processes take suturetak that can be placed in the body for medical purposes and mold it to the exact shape and size the customer requests. THM7 was conducted on August 1, 2016, and ST-20 on August 4, 2016. This assessment consists of observations from different shifts and employees as well as short interviews. Ergonomic assessment tools were also used to help identify the specific hazardous tasks. All associated tasks are based on an eight-hour workday, although at times employees do work extended hours in order to finish the task or complete the product lot. First, shift rotation issues will be explored, then issues with actual equipment and finally the hand tools used while operating the machines. The engineering team is evaluating the long-term options of which automatic machine would be the most effective for these processes. Short-term corrective actions have been found and are being evaluated by higher management.

There has been a history of ergonomic related injuries associated with tasks in the molding department. Most recently, ergonomic cases involving the forearms and elbows that was believed to be caused by running these machines. A rotation program was implemented along with cross-training from other departments and hiring new employees for molding. The suturetak machines cannot be stopped and need to be continuously operated. Due to customer requirements for quality purposes, a product needs to be in all one lot. If a machine is stopped and turned back on, it will be in a different lot. If the operator takes a break and lets the machine run, the polymer inside will heat up and burn. The average product made in an hour for the THM7 is around one hundred and twenty. The average product made in an hour for the ST- 20 is about eighty to ninety.

Workers were told that rotation of employees on the machine will take place every two and a half hours from management. When asked, the employees were not consistent in their answers if the rotations occur. In most interviews, skipping rotations was a popular theme. There was also an indication in the interviews that the employees do try to give breaks out, but the number of workers and machines being run does not make it possible at times. I was informed if they do not get the breaks needed, the employees will switch operator and the other employee who trims on the THM7. There should be two fifteen to twenty minute breaks and one half hour lunch break. Most workers admitted to usually getting a lunch break and one fifteen to twenty-minute break. When the second shift molder came in for his shift on the ST-20 machine, other molders mentioned how late he will be staying since the customer order hasn't been filled even half way. The reasons of the machine had technical difficulties and the other operator was newer which meant slower was given. In interviews, employees stated they will work as long as it takes to finish the task given, which leads into the problem of not receiving the proper breaks.

Workers stated multiple times that efficiency and speed are always the highest priority in the molding department. The belief that doing these tasks for many years is not as bothersome to the employees was a constant topic throughout the interviews. This instead is the complete opposite and employees who operate the machines longer will have a higher risk of developing an MSD. The molders explained that the employee who is the fastest would work the machine to get the job done quicker. The employees were all in the mindset that the products need to be finished as quickly as possible.

The hand tool used to hold the suture in a loop is used for every operator on the THM7 machine. That same hand tool is also used for the ST-20 and it is used to pull the suture from the roll that is at the back of the machine. The operator will pull this and hook it onto the piece in front of him using this hand tool. Handles of this length typically put pressure on the base of the palm where they compress against the carpal tunnel. The operators mentioned the pain they feel from constantly squeezing the hand tool until the machine has finished, and they are able to put more suture inside. Below are pictures of two different operators and the handle length is too short for both employees.

A hand tool is used when trimming excess suture from the material. The trimming is six snips per suturetak for the THM7 process and three times for the ST-20. Below I have pictured with a red line with each cut they will make on every piece for both processes. The hand tool has

rather short handle length. There are pictures of two different employees using the hand tool described.



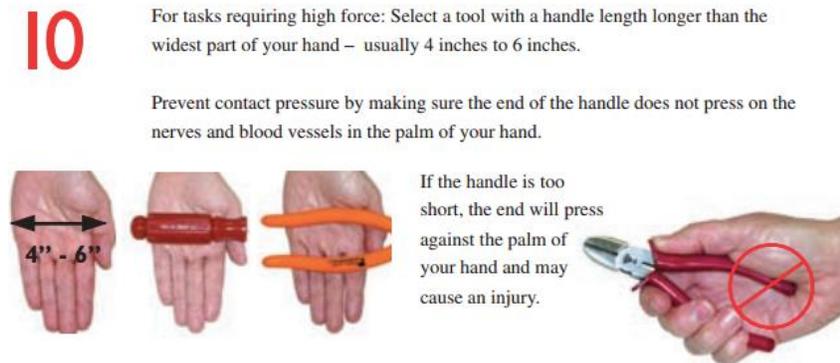
Blue Hand Tool Pictured Below: 6” all together, the handle is 3.25”

Blue Hand Tool Pictured Above: 6” all together, the handle is 3.25”



Yellow Hand Tool Pictured Below: 4” altogether, 3” handle part

In order to avoid awkward hand positioning and contact stress, ensure that ergonomic principles are considered when purchasing these tools. A variety of the hand tools with different lengths for the operator’s choice of comfortable would be ideal. The best tool is one that fits the job, fits the workers hand, reduces the force needed and can be used in a comfortable work position. “A Guide to Selecting Non-Powered Hand Tools” is a NIOSH publication that can be downloaded at: <https://www.cdc.gov/niosh/docs/2004-164/pdfs/2004-164.pdf>.



### Conclusion

Based on these three assessments, the interviews that were conducted and observations made it is clear that some changes need to be implemented. An engineering team is currently working on determining the most effective way to make THM7 process automated since it is the higher risk. Currently, the engineering team is evaluating a process that consists of a laser that cuts the suture itself. Although, all designs and ideas are still in the conceptual design phase. The engineering team is hoping for implementation in December but two years maximum. Until then, some changes can be made to decrease the risk level of MSDs. The highest priority short-term action plan would be implementing hand tools that follow ergonomic principles. Examples of hand tools that would be appropriate can be searched and found all over the internet. Another high priority action would be to conduct training for the molding employees. Ensure all workers have a basic understanding of ergonomics and the importance of the rotation that is in place. The rotation should be followed at all times and if any exception would need to occur, the manager should be notified.

References

American Psychological Association, (n.d). Retrieved 6, April 2017, from  
<http://www.apa.org/about/gr/issues/workforce/ergonomics.aspx>