

Naval Facilities Engineering Command Ergonomic Risk Assessment for Dental Center

Introduction

This report summarizes the ergonomic risk assessment conducted in September and November of 2003. The Prosthetics Lab and Supply Area were observed in order to determine sources of ergonomic stress and recommend improvements. This assessment is based upon interviews with supervisor, safety specialist, and employees as well as an evaluation by the Naval Facilities Engineering Command (NAVFACENGCOM) Hazard Abatement Ergonomist.

The Job Requirements Physical Demands Survey (JR/PD), an ergonomic survey was also administered to the employees in the Prosthetics Lab and Supply Area. The results of the JR/PD indicate the Prosthetics Lab as an ergonomic problem area with a score of **7** on a scale of 1 to 9 where 9 is a maximum value. The JR/PD assesses five distinct body regions: shoulder/neck, hand/wrist/arm, back/torso, legs/feet, and head/eyes based upon identified ergonomic risk factors and employee reported discomfort. For the Prosthetics Lab, the shoulder/neck, hand/wrist/arm, back/leg, and head/eye regions were found to have significant ergonomic risk. Ergonomic risk is based upon ergonomic stressors associated with the task and employee discomfort. A significant number of employees reported experiencing work-related pain or discomfort that does not improve when away from work overnight or over the weekend. Over half of the employees have seen a health care provider in the past 12 months for pain or discomfort that he/she feels is related to the job. A significant number of employees also reported pre-existing MSDs as well as conditions recognized as contributing factors for MSDs, which places them at a higher risk of additional or more severe WMSDs.

The JR/PD results indicate that the Supply Area is an ergonomic problem area with a score of **9**, which is the maximum value. The survey indicates the presence of both ergonomic risk factors and discomfort for a majority of the workers. The shoulder/neck and back/torso regions received the highest priority scores. The employees perceive this job as physically demanding. Organizational factors, which relate to morale and job satisfaction, indicate additional job stressors. A significant number of employees reported experiencing work-related pain or discomfort that does not improve when away from work overnight or over the weekend. Over half of the respondents (40% of the employees) have seen a health care provider in the past 12 months for pain or discomfort that he/she feels is related to the job. A significant number of employees also reported pre-existing MSDs, which places them at a higher risk of additional or more severe WMSDs.

The Prosthetics Lab and Supply Area were observed in order to determine sources of ergonomics stress and make recommendations to reduce the risk of work-related musculoskeletal disorders (WMSDs) and improve safety, health and productivity. Musculoskeletal Disorders (MSDs) are injuries and illnesses that affect muscles,

nerves, tendons, ligaments, joints, spinal discs, skin, subcutaneous tissues, blood vessels, and bones. Work-Related Musculoskeletal Disorders (WMSDs) are:

- Musculoskeletal disorders to which the work environment and the performance of work contribute significantly or
- Musculoskeletal disorders that are aggravated or prolonged by work conditions.

Recommendations to the command to further reduce the probability of injury include new equipmentⁱ and administrative controlsⁱⁱ. Recommendations are included with as much vendor informationⁱⁱⁱ as possible to assist in the evaluation of products and services. Input gathered from the workers, safety specialists, and other personnel to evaluate equipment before purchasing is recommended. This process will increase product acceptance, test product usability and durability, and take advantage of employee experience.

The command may request additional funds from the Chief of Naval Operations (CNO) Hazard Abatement (HA) Program to abate the risk of injury. Naval Facilities Engineering Command (NAVFACENGCOM) manages the CNO Hazard Abatement Program, which is a centrally managed fund to correct safety and health deficiencies beyond the funding capabilities of the activity. Information about the HA program can be found on the Naval Facilities Engineering Command web site www.navfac.navy.mil/safety and in OPNAVINST 5100.23F. Ch 12 Hazard Abatement. The deadline for submission is the end of February.

Prosthetics Lab

Purpose of the Operation: Fabricate prosthetic dental appliances

Population: Fifty to seventy personnel including enlisted, civil servants, and contractors

Injury Data: According to the Job Requirements and Physical Demands Survey results 23 employees have visited a health care provider for pain/discomfort that he/she feels is related to the job.

Description of the Operation:

Employees perform a variety of operations at individual seated workstations to fabricate and repair prosthetic dental appliances. Each workstation has a microscope or loupe, ventilation intake, and electric tools. Workers remain seated for most of the day.

Ergonomic issue description:

Repetitive Motions and Static Postures. The major ergonomic risk factors for the Prosthetics Lab staff are repetitive hand and arm motions in unsupported postures. The exposure is in combination with contact stress from grasping tools while applying force and contact with sharp bench edges. The tasks also have high visual demands, which require workers to assume static postures of the neck and torso for extended periods. A number of employees reported pain and discomfort in the arms, neck, shoulder and head due to static postures and visual demands as well as concerns about adequate ventilation.

Static postures are positions that are held for extended periods. Static postures increase loads or forces on the muscles and tendons needed to maintain those postures, which contributes to fatigue. Fatigue is a pre-cursor to WMSDs. Muscles require movement in order to allow blood flow. Blood flow brings nutrients to the muscles and carries away the waste products of muscle metabolism.

Prosthetics technicians exert sustained pinch grips while using small diameter tools some of which oscillate or vibrate. Awkward postures combined with high repetition and vibration can fatigue muscles and cause the employee to exert more force than is necessary. The majority of the tasks involve repetitive hand, arm, and wrist motions, which utilize the same muscle groups thus reducing muscle recovery. Inadequate muscle recovery leads to muscle fatigue and possible overuse injuries.

Employees sitting at their workstations are not always able to rest their feet comfortably on the floor while the chair is adjusted to a comfortable working height for the hands. Sitting with feet unsupported causes blood to pool in the feet. Employees who "tuck" their feet on the base of the chair, as shown in figure 1, can cause biomechanical stress on the knees and further reduce blood flow to the legs and feet. Reduced blood flow leads to static muscle loading and muscle fatigue.



Figure 1: Feet Unsupported




Figure 2. Contact Stress

Contact Stress: Using tools with small diameter handles causes contact stress to the palms which contain numerous nerves close to the skin surface. The work station edge presents another source of contact stress to the forearms as shown in figure 2. Contact stress results from compression of the soft tissue by a hard object. A concentrated force can reduce blood flow and nerve transmission as well as cause damage to tendons and tendon sheaths. Tools with narrow handles require a greater muscle force to grip, which can increase the contact force exerted on the hand. The force required to hold the tool is compounded by the force required to complete the task. Studies have linked forceful grips, and grips performed in awkward postures, to musculoskeletal disorders like DeQuervain's syndrome, arthritis, tendonitis, and carpal tunnel syndrome.

Recommendations

- Provide new workstations with proper ventilation, adequate lighting, ergonomic seating and padded edges to reduce contact stress. Kavo has delivered a rough quote of \$620,000.
- Foot rests should be provided for employees whose feet don't reach the floor comfortably. Refer to table 1.
- Experiment with tools with various sized grips and handle material to reduce the contact stress caused by the present small-diameter metal tools. Because workers do not all have the same size hands and grip strength, they should be allowed to select personalized tools. Having a varied tool selection during procedures is also suggested, so that workers can alternate gripping styles and strengths. In experiments with new tools, the following should be considered: overall tool and handle size and shape; weight; balance; maneuverability; ease of operation; and ease of maintenance. Hand tools with hollow or resin handles are preferred. For tools with shaped edges, round or compressible handles and carbon steel construction are preferred. For automated hand pieces, consideration should be given to lightweight, balanced models offering sufficient

power; built-in light source; pliable and lightweight hoses; 360-degree swivel mechanisms; easy activation; and easy maintenance. The shape of the shank--angled or straight should also be considered.

Table 1: Footrests				
Description	Vendor	Product	Estimated Cost	Figure
Footrest	Alimed 1-800-225-2610	Factory Footrest	\$100	
	Your local office supply store	Footrest		

Supply Area

Purpose of the Operation: Receive, stock and distribute supplies for the dental clinic

Population: Up to 10 active duty personnel

Injury Data: According to the Job Requirements and Physical Demands Survey results 4 employees have visited a health care provider for pain/discomfort that he/she feels is related to the job.

Description of the Operation:

Items arrive at the shipping and receiving dock throughout the day. Up to 700 items arrive per day in the busy season and at least 3 trucks deliver daily. Workers sort the incoming materials, stock some materials in the supply area, and distribute others to the clinics. Large items, such as furniture and refrigerators regularly arrive at the Supply Area. The heaviest item handled by the supply personnel is a 500 lb. sterilizer. Employees use carts and a dolly, borrowed from the Repair Shop, to distribute items to the dental clinics via a freight elevator.

Ergonomic issue description:

Heavy and Repetitive Lifting: Heavy awkward lifting can strain the back and place the worker at risk of injury. Federal Express, United States Postal Service, and United Parcel Service arrive at the dock daily to deliver items. Employees retrieve the items from the delivery person. The dock is up to 18" lower than the delivery vehicles, which forces the workers to straddle the gap, as shown in figure 3, and pass boxes or lift heavy carts arriving by semi-trucks up to the to the dock level from the truck which is lower than the dock. A 700 lb. dock leveler is available for use but is still 6-8" too short for a semi-truck. The items delivered are then carried or wheeled into the supply area where employees sort them and again frequently lift items onto the storage shelves, as shown in figure 4.



Figure 3: Delivery



Figure 4: Storage

Recommendations:


- A flexible, compressible conveyor would allow the delivery person to unload the trucks onto a conveyor. The workers can then simply push the items on the conveyor from the dock to the supply area in order to reduce heavy, repetitive lifting. See table 2
- A scissor lift pallet jack would allow the workers to move items on pallets throughout the Supply Area and raise the pallet to a proper working height in order to encourage neutral postures while unloading items. See table 3.
- A stepladder with railing would allow workers to stock shelves in a safer manner than the existing ladders. Refer to table 4
- An appliance dolly would allow the workers to easily move heavy items throughout the dental clinic without having to wait to borrow one from the Repair Shop. Refer to table 5
- A loading dock scissor lift would allow the height of the dock to be adjusted to the height of the delivery van in order to reduce heavy lifting. Refer to table 6.
- The employees should be trained in proper lifting techniques as well as the importance of storing the heaviest and most frequently used items in the power zone- between the shoulders and the knees.
- Encourage workers to take stretching breaks during the day to relieve discomfort and encourage muscle movement. A physical therapist can instruct the workers in stretching exercises appropriate for their job or refer to the following websites. The following web sites include exercises that can be printed and posted. Sources should be cited when reproducing information. Web site links updated Jan 2002.


http://www.steelcase.com/servlet/ToolsInsightsServlet?ACTION=5&CONTENT_ID=202

www.shelterpub.com/fitness/office_fitness_clinic/OFC_online_stretches.html

<http://www.ucsc.edu/opers/wellness/pages/officestretches.html>

www.safety.duke.edu/Ergonomics/90seconds.asp

Description	Vendor	Product	Estimated Cost	Figure
Powered Flexible Conveyor	Peak Logix 703-819-6061	Flexible Power Roller Conveyor System: Compacted Length 12' Expanded length 36' 5" Roller Centers 1.5" Rollers	\$9200	
Non-Powered Flexible Conveyor	C&H 1-800-558-9966	Nestaflex NON-POWERED flexible conveyor: 10'6"-35'1 625 lb. capacity	\$2827	

Description	Vendor	Product	Estimated Cost	Figure
Scissor Lift Pallet Jack	C&H 1-800-558-9966	Wesco High Lift Pallet Positioner	\$723	
	Lab Safety 1-800-543-9910	Multiton High Lift Trucks	\$1284.00	
	Grainger	Bishamon Skid Lift	\$2089.00	

Description	Vendor	Product	Estimated Cost	Figure
-------------	--------	---------	----------------	--------


Step Ladder with handrails	C&H 1-800-558-9966	Mobile Office Stands (available in different heights) 2 Steps with handrails 73-736DA	\$144	
	Peak Logix	Contact Ernie Taylor at 703-819-6061 for pricing		


Table 5: Appliance Dolly				
Description	Vendor	Product	Estimated Cost	Figure
Appliance Dolly	Peaklogix 703-819-6061	Appliance/Vending Machine Cart 700 lb. Capacity Auto-ratchet rewind	\$340	
	Lab Safety and Supply 1-800-543-9910	Wesco Vending Truck	\$342	
	Grainger	Convertible Hand Truck	\$298	

Table 6: Loading Dock Scissor Lift				
Description	Vendor	Product	Estimated Cost	Figure
Loading Dock Scissor Lift	Peaklogix 703-819-6061	Loading dock scissor Lift Smooth deck with textured surface Recess lift into concrete 6"-8" concrete slab provided	\$14960	

*Some information has been removed from this report that is specific to the activity.

ⁱ Equipment purchase without proper and repeated training will not mitigate risk and may in fact increase hazards.

ⁱⁱ Administrative controls are management-controlled work practices and policies designed to reduce exposures to work-related musculoskeletal disorders (WMSDs) hazards by changing the way work is assigned or scheduled. Administrative controls reduce the exposure to ergonomic stressors and thus reduce the cumulative dose to any one worker. Examples of administrative controls that are used in the ergonomics context are employee rotation, employer-authorized changes in the pace of work, and team lifting.

ⁱⁱⁱ This report does not constitute an endorsement of any particular product. Rather, it is a recitation of how Navy personnel have addressed a particular work place safety issue. Neither the Navy nor its employees and agents warrant any product described in this report for any use, either general or particular.