Work Product	Patient File Report	
Date Work Completed	September 2014	
Employer	[redacted]	
Applicant's Role	Ergonomist	
Industry Sector and Context	Along with knowledge transfer and worksite assessments, a service offered by [redacted] is the clinical assessment of injured or ill workers. On top of ergonomists, [redacted] employs industrial hygienists, occupational health nurses, and medical physicians whom work together to perform patient intake for injured or ill workers that have been denied a WSIB claim. Through patient medical assessment, review of medical history, interview, and review of work related tasks and demands (e.g., job descriptions, physical demands analyses) the [redacted] staff will assess whether the demands and exposure to work tasks and environments are correlated with injury or illness and develop a report issued to the worker, employer, and WSIB	
Page No.	**Competency**	**Description of how Competencies are met**
1	5	Through collaboration with the patient I was able to decipher their work history, interpretation of job demands, clarify tasks as described in the employer's PDA, and gain empathy for how a task or duty was fulfilled
2	4	For a holistic approach to identifying the mechanism of injury I collaborated with the [redacted] medical physician to review the case to provide an expert opinion based on their review of the patient's medical history and their physical assessment of the patient's injury
3, 4, 6	6	Through review of multiple sources (job description, employer's PDA, and interview with the patient) I assessed the objective physical demands of the job against tolerances and threshold values from industry standards and evidence based scientific papers
7	9	Succinct conclusion that ties together the risk factors identified in the patient's work history, the breakdown of the job demands, the quantification of exposure, and the increased likelihood of the MSD being related to the demands of the job
6,7	15	Demonstrated the interpretation and application of biomechanical, psycho-social research to the task demands of the patient as it relates to their likelihood of MSD development
1-9	2	The body of the report demonstrates thorough review, synthesis, and utilization of research-based knowledge from peer reviewed scientific articles in the domain of biomechanics, ergonomics, and injury mechanisms

September 26th, 2014

[redacted]
[redacted] Road
Windsor, Ontario, Canada
[redacted]

Dear Mr. [redacted]

Re: [redacted] **Our Chart:** W13-4937 **WSIB#**: [redacted]

Introduction

I met with Ms. [redacted] on September 18, 2014. The purpose of the meeting was to document, in detail, the physical exposures of her work tasks as they relate to her current condition. Although the work was not observed, detailed information was collected from Ms. [redacted]'s description of her workload and job tasks as well as the Physical Demands Analysis (PDA) included from her employer.

To begin, it should be outlined that occupation-related musculoskeletal disorders (MSDs) can be caused by the presence of one or any combination of the following risk factors: repetition, awkward postures, static postures, high forces, and contact stress. When these factors exist simultaneously, the risk of development of MSDs is significantly increased. Similarly, when workers have been exposed to the risk factors for prolonged (continuous minutes or hours) or extended (weeks or years) periods of time, their cumulative risk of injury is significantly increased (Punnet & Wegman, 2004).

Although some musculoskeletal disorders occur at one specific moment, many more injuries result from repeated strength demands coupled with lack of significant rest periods that together, culminate to exceed the tissue (muscles, tendon, ligaments, etc.) tolerance of an individual (McGill, 2002). Likewise previously injured workers may be more at risk of developing an injury than a rested and healthy worker. Since an injury lowers one's capacity and overall tissue tolerance of that area, returning to pre-injury duties before adequate rehabilitation could result in increased risk of developing a more severe or permanent injury (Putz-Anderson, 1988) or overusing another body part to compensate for the current injury. Occupational stressors can exacerbate the daily wear and tear and eventually lead to degeneration whereby even a minor event can cause an injury.

Purpose

To discuss the physical exposures associated with Ms. [redacted] ([redacted]) [redacted]'s employment with [redacted] ([redacted]) in Windsor, Ontario, in order to identify any work-related hazards associated with an increased risk of developing bilateral shoulder tendonitis and neck pain (soft tissue and radiculopathy).

Background

Ms. [redacted] was employed with [redacted] in Windsor, Ontario, where she worked for approximately 8 years, rotating various job tasks (retrieving, stocking, assembly). She worked part time for the first 11 months of employment before being brought on full time for a total of 40-50 hours per week. Ms. [redacted] reports that the onset of significant right shoulder pain first began in 2009. After pain persisted she filed a WSIB claim (#[redacted]) in September 2009. In April 2010 she had onset of left shoulder pain, followed by onset of neck pain in 2011. Her last day of employment with [redacted] was in March 2012 when she was terminated on the grounds of absenteeism. Over the past several years she has had frequent physical therapy sessions and in March 2013 underwent rotator cuff reconstruction.

Injury Description

Following a review of Ms. [redacted]'s medical history and a physical assessment, [redacted] Consulting Physician Dr. [redacted] indicated the following injury diagnosis:

1) *Rotator cuff disease, bilateral shoulders with initial onset of symptoms involving the right shoulder in 2009 with subsequent involvement of the left shoulder … Findings have confirmed been confirmed with diagnostic investigations including ultrasounds and MRI … She has permanent restrictions involving the bilateral shoulders. Her findings are consistent with the type of work required with over shoulder lifting, repetitive rotational movements of the shoulders bilaterally with reaching, pulling, and pushing. Her height at 5'1" was a significant factor. Her work at [redacted] is considered highly repetitive.*

2) *Neck pain, soft tissue pain involving the neck as well as C5-C6, disc producing radiculopathy. Her work duties over the years have involved fixed neck flexion for prolonged periods of time especially with the assembly and sew jobs. I would concur with Dr. [redacted] that it is related to her work.*

Relevant Anthropometrics

Height: 5'1"

Hand Dominance: Right

Job Description

As an employee with [redacted], Ms. [redacted] was responsible for a number of different assembly/production tasks. A typical work shift was 8 hours in duration, with two-10 minute and one-20 minute breaks. [redacted] employed a 2-hour rotation between the following jobs, noted by the PDA and Dr. [redacted]'s summary:

1) Accessory to Web: Attach anchor and buckle to webbing
2) Buckle Anchor Sew: Sew webbing to buckle and anchor
3) Boot Assembly Date Stamp: Pull Boot over anchor and strap, Test assembly and Date stamp
4) Boot/Tack Sewing
5) Inspect and Pack Date stamp: Date stamp, sew webbing, inspect part and pack

Work Production

Ms. [redacted] indicated that when an employee of [redacted] was absent from work, the remaining workers on that line are required to fill the absent position, increasing their workload for the day. As stated in the PDA, and confirmed by Ms. [redacted], the production goal per shift at Ms. [redacted]'s workstation is 1700 parts/day (240 parts/hour). Ms. [redacted] indicated that workers were highly pressured by supervisors/managers to meet this goal.

Risk Factors for Bilateral Shoulder Tendonitis

Ms. [redacted] is 5'1" (~155 cm) tall and considered herself to be a shorter member of the workforce at [redacted]. For this reason, she indicated that most of the reaching, pushing, pulling, and lifting tasks would occur above her shoulder or head height due to the design of the workstation and assembly lines. Throughout the PDA, which documents the various jobs in Ms. [redacted]'s work rotation, the maximum heights measured for reaching, pushing, pulling, and lifting were indicated in the range of 90 cm – 128 cm. Ms. [redacted] disagreed suggesting that these heights were likely underrepresented. Despite the indifference, the 128 cm indicated in the PDA is at the approximate level of her shoulder. It is likely that the PDA data were obtained from a taller worker, as the PDA indicates that there was no required pushing, pulling, or lifting "above the shoulder".

The PDA indicates that the reaching, pushing, pulling, and lifting tasks required for Ms. [redacted]'s job rotations in the range of 90 cm – 128 cm (at or near her shoulder height) in almost all cases occurred either "Frequent: 34% – 66% of the cycle" or "Constant: 67% – 100% of the cycle". This accounts for a substantial part of the work day, meaning she can spend anywhere from 3 hours – 8 hours of a workday performing tasks at these heights (or higher based on Ms. [redacted]'s indication). Research consistently indicates that frequently moving hands above shoulder level for a substantial portion of a workday is associated with increased risk of shoulder/arm injury (Hagberg et al., 1995; Sluiter et al., 2001; Miranda et al., 2002).

Regarding the weights of objects pushed, pulled, gripped, and lifted, the PDA indicates that majority of objects were "Light", either determined by the employer to weigh up to 4.5kg for "Frequent" activity, or "negligible" for "Constant" activity. Considering the very high repetition of tasks, "negligible" is inadequate reporting as it gives no indication to the weight and could essentially be anything below 4.5 kg. Regarding the determined 4.5 kg weight for objects frequently pushed, pulled, gripped, and lifted, researchers have determined that when handled repetitively in high frequency, as per in the case of Ms. [redacted]'s work tasks, objects of 4 kg or greater present an increased risk of shoulder pain and injury (Sluiter et al., 2001). This was confirmed by Frost et al. (2002) who noted that there is increased risk of developing shoulder tendonitis associated with the combination of the following factors (all of which present in Ms. [redacted]'s work history with [redacted]): repetitive work tasks, notable force requirements, and lack of micro-pauses. It is highly plausible that Ms. [redacted]'s work history of excessive work at or above shoulder height with objects nearing evidence-based risk threshold weights have contributed to her condition of bilateral shoulder tendonitis.

<u>Risk Factors for Soft Tissue Neck Pain and Radiculopathy</u>

In Ms. [redacted]s November 14, 2013 WSIB Denial Letter, it stated:

"Mr. [redacted] indicated that while reference to the worker's shoulder was made, there was minimal information provided about her neck and that the worker failed to provide evidence to support her cervical DDD as being related to her work. Mr. [redacted] indicated that the worker's problems with her neck are related to degenerative changes and that there were no risk factors present in the job she performed".

It should be first indicated that a trend between aging and degenerative disc disease (DDD) has been linked in some research (Miller et al, 1988; Powell et al, 1986; Pritzker, 1977). However, it is suggested that age is not the only primary factor in the onset and increased severity of DDD as substantial individual differences have been observed where young individual's exhibit highly degenerated discs whereas elderly individuals exhibit healthy discs (Boos et al, 2002). Clinical research efforts have indicated that highly repetitive loading, similar to that seen in a repetitive work-environment like Ms. [redacted]'s, is linked to disc herniation and degeneration (Callaghan & McGill, 2001). Below, several risk factors of the neck which have been heavily linked to increased risk of pain and injury, will be discussed as they relate to Ms. [redacted]'s work history with [redacted].

The PDA for all five of her jobs in rotation indicate her required Neck Action as "sustained forward neck flexion at approximately 30º to 40º depending on the height of the employee". Furthermore, the frequency of Neck Action is classified as a "Constant Demand", where it is performed for 67-100% of a work cycle (up to 8 hours per day). This objective information, supplied directly from the PDA of the employer, determines that Ms. [redacted] is required to constantly maintain a flexed neck posture at any and all of her jobs in rotation for an 8-hour work day. This duration and frequency of flexed neck postures are consistently linked to neck MSDs in scientific literature.

Sluiter et al. (2001) indicate that highly repetitive extreme neck flexion activities with inadequate rest periods (e.g., less than 10 minutes of rest per 60 minutes of work) was correlated with increased risk of neck injuries. More specifically, Ariens et al. (2001a), found a positive relation between neck flexion and neck pain, suggesting an increased risk of neck pain was found for people working with a neck flexed at least 20º for more than 70% of the workday. In context, Ms. [redacted]'s PDA determines that she would be required to hold an even greater degree of neck flexion (30º to 40º) for approximately at or upwards of 70% of the workday.

Winkel and Westgaard (1992) explain the biomechanical implications of extreme neck flexion and how it relates to stress and injury:

"In extreme positions with the whole neck flexed, the extensor muscle activity of the cervical spine is not increased compared to the neutral upright head position although the load moment of the C7-T1 motion segment is increased 3-4 times. Thus a considerable stress is generated in the ligaments and joint capsules during extreme flexed positions of the cervical spine."

Ms. [redacted]'s neck pain is consistent with definitions of mechanical neck pain and radiculopathy (Hagberg et al., 1995). Based on findings from biomechanical and epidemiological literature, coupled with the medical opinions of various medical professionals in her file (including [redacted] Consulting Physician Dr. [redacted]), it is likely that her neck condition is heavily related to her work history which required her to hold extreme neck flexion postures for the vast majority of her work shifts. For these reasons it is plausible that degeneration was accelerate by her work demands in severe neck flexion.

<u>Previous Ergonomic Assessments – Recommendations</u>

An Ergonomist (Mr. [redacted]) from [redacted] consulted with Ms. [redacted]'s employer regarding strategies to allow her to work within her limitations/restrictions as determined by the WSIB. In the May 30, 2011 report, Mr. [redacted] indicated that a temporary (6-8 week) period of work activities on the "F-24" line would impose physical demands within Ms. [redacted]'s capacity (before transitioning back to her pre-injury "D-10" line), which agreed with her following limitations:

- Avoid sustained repetitive use or arm overhead
- Avoid repetitive outreaching
- No heavy lifting
- No repetitive push/pull carry

Despite the recommendations, Ms. [redacted] noted that significant pain and difficulty completing tasks persisted on the transitional "F-24" line, documented in the July 15, 2011 WSIB RTWS Intervention Memo/Plan. In the August 25, 2011 WSIB RTWS Memo/Plan, it is documented that her pain and difficulty persisted when placed on a different transitional "F-2" line. Ms. [redacted] noted that, contrary to the information contained in the Ergonomic Assessment, both "F-24" and "F-2" transitional lines still required repetitive reaching and overhead arm use

for her which continued to aggravate her condition. Additionally, her employer indicated that they would not tolerate a modified work schedule of 4 hours/day as suggested in Dr. [redacted]'s medical note (July 11, 2011).

Work Demands

In regard to the overall work demands of Ms. [redacted] during her employment at [redacted], a number of risk factors were identified.

Occupational lifting guidelines are most often based on the findings and output of the Revised NIOSH Lifting Equation (Waters et al., 1993). In the Revised Lifting Equation, various multipliers (lift height, coupling, frequency, etc.) determine the Recommended Weight Limit (RWL). The maximum RWL, under ideal infrequent conditions, is 23 kilograms. In the PDA provided by [redacted], a "Medium" lift is determined as lifting an object that weighs up to 22.6 kilograms – essentially the maximum safe occupational lifting weight in perfect work conditions. Some of Ms. [redacted]'s lifting tasks require her to lift and manipulate "Medium" weighted objects on a highly repetitive production line. This is a very high risk of injury considering that weight (22.6 kilograms) would only be safely lifted in the occupational setting at a frequency of approximately 1-3 times/ hour, based on the Revised Lifting Equation. Additionally, the PDA indicates that "Heavy" and "Very Heavy" lifts can meet or exceed 45 kilograms, almost double the recommended maximum allowance. These weights far exceed evidence-based guidelines and can pose serious injury risks to workers required to handle them, even if only handled once per work shift (Waters et al., 1993).

Ms. [redacted]'s work duties were highly repetitive with limited rest breaks. The PDA indicates that through the identified Work/Rest ratios for four of five jobs in her rotation:

- 10 seconds work/ 6 seconds rest
- 12 seconds work/4 seconds rest
- 12 seconds work/ 4 seconds rest
- 14 seconds work/ 2 seconds rest

Literature indicates that too little recovery time, as defined by less than 10 minutes of rest scheduled for every 60 minutes of work activity, is associated with increased risk of work-related MSDs (Sluiter et al., 2001). The PDA indicates that Ms. [redacted] was given a 10 minute break every 120 minutes, less than the aforementioned suggestion. From the work/rest ratios indicated above, certain jobs (14 seconds work/ 2 seconds rest) only afford her approximately 5 minutes of rest per hour. Further, the type of rest break allowed is just as important as the duration. McGill (2002) notes the following regarding work breaks:

> *"A properly designed rest break consists of the opposite activity (and consequently the opposite loading) from that required by the job. For example, the sedentary secretary will be best served by a dynamic rest break. The welder, on the other hand, will be better served with a rest and perhaps a stretch."*

Ms. [redacted] indicated that her supervisors and managers strongly enforced production goals. When production goals were not achieved, meetings would be held where individuals whom were not maintaining the necessary production pace were identified and/or coached. Psycho-social research has linked high pressure from employers to meet production rates in certain timeframes with increased rates of MSD development (Ariens et al., 2001b), thus these production pressures may have contributed to her conditions.

Other Factors

Ms. [redacted] reported that she has had no involvement in organized sport or any similar activities outside of work that would aggravate her shoulders and neck or contribute to her conditions. She is a non-smoker.

Conclusion

In closing, the risk factors of Ms. [redacted]'s work duties involved repeated reaching, pushing, pulling, gripping, and lifting objects of notable weight at or above her head and shoulder level, as well as prolonged periods of severe neck flexion. Based on the epidemiological, biomechanical, and physiological studies reviewed, evidence suggests that the physical exposures of Ms. [redacted]'s work duties increase the likelihood of bilateral shoulder tendonitis and soft tissue neck pain and radiculopathy. The relevant literature suggests that these injuries are gradual in onset and caused due to the repeated nature of her work tasks, coupled with high forceful exertions, in awkward postures, over extended periods of time. The pressure to reach production goals likely contributed to a workload well exceeding her physical capacity. The above work-related factors experienced while employed with [redacted] have likely contributed to her conditions.

If you have any additional questions and/or concerns please do not hesitate to contact me.

[redacted]

[redacted] BKin, MSc, ACE* Member
Ergonomist
Telephone: [redacted]
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*Association of Canadian Ergonomists

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