Research and Workplace Innovation Program

Project: To Create Indicators and Tools for Supervisors to Use at the Jobsite in Identifying Potential Musculoskeletal injuries Associated with Drywall Installation

Final Report

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The purpose of this project was to develop indicators and tools for supervisors to use in identifying potential musculoskeletal injury (MSI) and thus, by identifying potentially injurious movements, correct them. These indicators would be specific to tasks associated with drywall installation procedures and tools. Corrections and recommendations to movements were expressed with verbal and visual cues using smart phone and tablet computer video feedback.

Movement guidelines have been previously developed and are available but they do not relate well with the drywall industry and recommendations come across as either to general or not applicable for some of the tasks undertaken. Time loss MSI experienced by Gypsum Drywall Interiors Ltd. (GDI) workers include back and neck strain, with either muscle strain or tear, intervertebral disc issues, and shoulder injuries (rotator cuff injuries). We need to know when a worker is on the cusp of becoming injured and to be able to say that his or her task is paused, passed onto a fresh worker or rest until strength and control has returned.

The tasks can be repetitive and physically demanding and as fatigue sets in improper biomechanics or weak movements occur, with the potential to injure. The supervisor, or even the co-worker, is in the best position to provide feedback on the worker's movement and also able to see a decrease in the workers rate of production: if there is a marked decrease in rate of work this is also an indicator of fatigue.

Although drywall installation shares many common movements with other trades, there are specificities that come in the form of:

- Sub-disciplines: steel stud wall fabrication, board application, taping
- Duration, intensity, repetitiveness of a task – piece worker vs. hourly worker
- Work positions, and ergonomics.

Objective:

This project's objective was to reduce the frequency and severity of MSI by supervisors recognizing incorrect and potentially injurious movements and then correcting the situation.

Although Safe Work Procedures have been written and are readily available for all workers, MSI still occur. This would suggest that under certain conditions a worker's physical movement is inefficient or mechanically incorrect either due to fatigue or the worker not being aware that he or she is executing a movement poorly. With respect to productivity, it could be hypothesized that the worker would be more productive over the course of the project due to more efficient movement. Tapers and drywallers will frequently work to fatigue rather than working at a pace that can be sustained.

Foremen and supervisors should be the best to monitor this as they are in constant contact with the workers throughout the project, and have influence on the rate of production and scheduling. In the past they have not been as successful as they potentially could be, possibly due to a lack of understanding of correct movements or of the costs associated with time loss injuries. An analogy would be: "They know what an unsafe scaffold looks like and how to make it comply, but they don't know what an unsafe movement looks like".

Current technology found within tablet computers and an inexpensive, easy to use video imaging program, Coach's Eye (www.coachseye.com), were used to teach and correct movements at the jobsite under working conditions. Coach's Eye was developed for movement analysis and quick feedback by amateur and professional sports coaches and trainers. It allows for frame by frame analysis as well as drawing landmarks on the image to help clarify explanations. The Windows Surface tablet was chosen because of its battery life, screen size, camera quality and relative low cost.

Who Participated, and Their Roles

Project participants included GDI employees, occupational health consultants, members of industry regulatory bodies and of the Workers Compensation Board of Manitoba

Specific roles were:

- **Project Coordinator:** GDI employee, responsible for funding application, administration, final development of project tools, training of foremen and workers

- **Project Consultants:** physiotherapist and physician, both specializing in occupational health

- **GDI Supervisors/Foremen and management:** ensure that the project did not conflict with or compromise production; foremen would be assessing and correcting workers as per project guidelines

- **GDI Workers:** perform tasks and cooperate with the project to ensure that results were true and that the corrections were practical

- **Advisory Committee:** consisting of GDI managers, representatives from Safe Work, Construction Safety Association of Manitoba and the Workers Compensation Board of

Manitoba; to review project milestones, results, advise on any changes in process or recommend different actions, with meetings held on a quarterly basis

Procedure

Prior to any analysis of and creation of indicators could be conducted we needed to first, with the work of qualified consultants:

- Review past incident reporting to identify tasks where there are higher rates of injury, i.e. overhead work.
- Identify what the injury is and its mechanism.

Next:

- Educate supervisors on correct movements
- Show what is Good vs. Bad, acute and overuse
- Signals or signs of imminent injury
- Have them demonstrate with video feedback

Procedure for correcting worker using the developed indicators:

1. Observe work,
2. Document movements or work by using video, images
3. Immediate analysis of images with worker, compare to ideal if possible
4. Feedback to worker, coaching
5. Worker to practice
6. Re-evaluate, observe again
7. Provide feedback positively, and/or correct further

Project Events, Observations & Interventions

The project was divided into two phases, with the initial phase running from April 2014 to December 2014. It consisted of the following activities:

- training foremen and supervisors in biomechanical principles and on purpose of this project
- identifying qualities of injuries that fell within the scope of this project
- reviewing past incident reports and WCB reports, identifying injury rates
- gathering observations with tablet devices, analysis
- developing the indicators of potential MSI and reference materials for sites and foremen
- allow foremen to use the tools
- follow injury rates, intervention activity

The second phase ran from January 2015 to May 2015. It focus was mainly on maintenance of observation and intervention frequencies, and further analysis of injury rates. It was identified however that further reinforcement of training of workers and foremen was required and this has been reflected in the financial summary below

Over 16 job sites were visited. Observations and video capture using the Windows tablet computers were made. The observations were typically made in the afternoon. 21 analysis of work were made between May and August 2014 for the purposes of creating resource materials for the project. Checklists and a table of images demonstrating right vs wrong were also created. Video capture and analysis is still continuing during job setups and site safety inspections.

Project Costs

Costs for this project were funded by the Research and Workplace Innovation Program (RWIP), with the Workers Compensation Board of Manitoba.

Project Outcomes

We experienced a reduction in injuries attributed to ergonomic issues due to setup of work platforms, ladders, tool use and inefficient movements. The latter, movements, have been the most difficult to address as a newer way is always in competition with an old, learned and practiced movement and its perceived lower, but short term, productivity.

Within six months of the project's start there was an observed improvement and an increased awareness of body position during tasks. Both workers and foremen are now more aware of simple changes that can be made to scaffold heights and they are more welcome to the idea of taking a moment to adjust equipment now that they know what a less strenuous position looks like.

For year 2013, GDI experienced 10 MSIs per 101 full time equivalent (FTE) workers which could be attributed to body positioning or ergonomics. 2014 closed with 5 per 98 FTE workers, for injury rates of 9.9 and 5.3 respectively; **a 49% reduction**.

This reduction could be attributed to the focus put on controlling the mechanism of injury and an awareness of the workers on his or her-own posture and methods of work.

The indicators of potential injury presented during the course of work were determined to be:

- "Head forward" posture
- Lordosis-lumbar spine
- Kyphosis- thoracic and cervical spine
- Extended knees when lifting from floor
- Elbow "out" during shoulder flexion and extension
- Cervical spine extension during work of long duration, hands above the head and always reaching
- Inward twisting (pronation) of arm and hand during elbow extension
- Unilateral work, using one hand for all tasks

Images of these indicators were integrated into a checklist and a jobsite poster for reference by all workers.

As mentioned above, GDI experienced 10 MSIs per 101 full time equivalent (FTE) workers which could be attributed to body positioning or ergonomics. The year of 2014 closed with 5 per 98 FTE workers, for injury rates of 9.9 and 5.3 respectively; a 49% reduction. This rate was calculated as:

$$Injury\ Rate = \frac{\text{number of identified MSI}}{\text{number of FTE workers}} \times 100$$

This reduction could be attributed to the focus put on controlling the mechanism of injury and an awareness of the workers on his or her-own posture and methods of work. Currently, at the closing of this project there are no injuries attributable to the identified injury mechanisms.

For 2015, to date, GDI's injury breakdown is as follows:

8 time loss injuries:

- 4 from falls and strikes (icy, from steps, material handling, awareness)
- 2 bodily reaction icy conditions
- 2 over exertion (lifting too large)

Repetitive motion injuries from WCB reports

2012: 4
2013: 1
2014: 0
2015, to date 0

Adoption by Supervisors

Supervisors have been working with the video and still images during setup but there is some reluctance to use the imaging software. Use of this method means stopping, fiddling with the camera and then trying to come up with an explanation. This was identified as an obstacle at the onset of the project. The checklists or indicators are more useful and available.

Foremen and Supervisors are now asking for an assessment of a job setup and this was not done on the past. Eight requests came from supervisors who saw a need in assistance with job set-ups where repetitive, long term work was going to take place, including the office. They can see that something is not right but may be not confident enough in responding or may feel that it is outside of their scope of work.

Ranking the success of the supervisors would leave them with a subjective ranking of 70% success: not a failure in that because they are now involving themselves in setup and corrections, but not getting full marks from not using all tools available to them. Over the course of the project 3 infraction notices were given for improper lifting, and this would not have happened in the past.

Interventions Discussion

Observations with video feedback of overhead work have led to changes in equipment ordering, including PPE. Tapers are happy with using their stilts instead of baker scaffold platforms: speed of work, ability to work closely to the wall or ceiling and apply force with tools. Their stilts are also very easy to adjust for height and because they are worker specific, spend less time adjusting them. Work platforms, or scaffolds, are now being set up with screw jacks and combinations of different sizes of sections to fine tune working heights. It is interesting to note that we have always had this ability but perhaps an increased awareness of positioning has led to this change in setup.

Unanticipated problems arose where a worker was simply not able to move into a better position due to pre-existing conditions. On several occasions workers were unable to do so due to old muscle imbalances, or loss of range of motion in some joints due to prior injury. It would be safe to say that we could anticipate an MSI from these individuals in the future. Certain tools did not allow for better movements as well: simple drywall knives, a universally accepted tool, still have a poorly designed handle for long term, repetitive work. This handle, or grip, affects shoulder rotation.

PPE changes have come about from an analysis of overhead drilling, where dust and falling debris are hazards. Glasses with foam gaskets or better still a goggle with an incorporated dust –proof face shield are recommended and provided to allow the workers to get under the drill

allowing for a stronger position (i.e. Ed V at Cornerstone). This protection is hardy and costs between $15 and $25.

As mentioned in previous discussions, workers could be better trained. Further education must be done in the areas of physical fitness: flexibility training, core muscle control and functional strength. Optimally the worker will arrive for work and at time of hire physically prepared for the task, without muscle strength imbalances, and physically literate; if this were the case many interventions would not have to take place. Supervisors also need to be reminded of work to rest ratios, which are very difficult to monitor at a construction site. Employers should be aware of a worker's physical limitations prior to hiring and once hired emphasize that physical fitness is a criteria for work but, with that, the employer should make efforts to help the worker maintain physical fitness, either through education, onsite assistance, or access to training.

Moving Forward

How do we move forward, maintain these processes and transfer these methods to other job sites and industries? Within GDI, with the help of this project, the process of assessing tasks for MSI hazards is now well rooted. Video feedback was shown to be very successful and more persuasive in changing a practice than by using verbal cues. Also, the novelty of using a sports-based software program made some tasks more interesting and expressed to the workers that their movements can be related to athletic efforts. It was not uncommon to hear the comment: "well that just doesn't look right" once it was analysed on the screen.

The simplicity, portability and available software of the tablet make it a great tool for assessing how workers move during any task. The procedures developed for this project could be transferred to any workplace: office workstations, manufacturing, or other construction sectors. The images provided not only feedback to the workers but more information to the supervisor with respect to setting up tasks, and to look hard at what tools and materials are being used.

Timely video feedback to the workers, using the same tools and protocols that sports coaches use on the pool deck or snow, will prove useful and beneficial to both the workers and their employers.

APPENDIX

Sites observed:

1. Destination Maternity
2. Polo Park Zellers Renovation
3. Polo Park H & M Renovation
4. MLCC Steinbach
5. 1726 Taylor
6. 2nd level Polo Park, Zellers re-do
7. CMU Library
8. Cornerstone Apartments
9. 500 Waterfront Drive.
10. Tache Hall, University of Manitoba
11. Rothesay Apartments
12. GDI offices desk workstations.
13. Artista Homes offices
14. 1620 Wellington Cres
15. 71 Deerpointe
16. Heritage Landing Apartments

Attached

Foreman's Checklist

Right Way vs Wrong Way poster

GDI orientations to foremen: RWIP objectives and risk assessment, Reduce the MSIs.

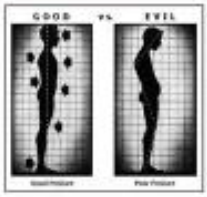
MSI Reduction Checklist

EVERYTHING affects the back and shoulders!!!

Task location:			Date:	
Overhead Work	***Very good!***		**Evil**	
Height of floor/scaffold/ladder:	Work in front of eyes	☐	Looking up	☐
	Can equipment be adjusted?	☐	Problems adjusting height?	☐
Duration of work:	Opportunity to lower hands every 30 seconds?	☐	Are the hands constantly up? (5-10 minutes up 6 x per hour) 6 x per shift	☐
Body position:	Small arch in lower back, chest up and out	☐	lower back arched, upper back appears to be behind hips?	☐
Lift from floor	***Very good!***		**Evil**	
Head position:	Looking forward?	☐	Looking at the floor?	☐
Back position:	Upper back is straight by pushing the chest up and out	☐	Rounded upper back?	☐
	Shoulders pulled back?	☐	Shoulders rolled forward?	☐
	Slight arch in lower back because the butt is sticking out	☐	Rounded lower back?	☐
Load position	Load close as possible to body?	☐	Reaching out during the lift?	☐
The lift:	Back maintains the above position?	☐	Back is bent/rounded?	☐
	Torso remains upright?	☐	Leaning forward- back parallel with ground?	☐
Placing board high on wall: Body position/ foot placement:	Close to wall?	☐	Have to reach to place and screw off?	☐
Torso/ back:	Chest up?	☐	Upper back round?	☐
	Shoulder blades flat?	☐	Shoulder blades sticking out?	☐
	Abs tightened up?	☐	Soft tummy?	☐

There is a better way to move!

MSI Reduction:
Images for comparison to ideal



Good is achieved by simply **tightening up your gut**.
- It pushes everything upwards.

MSI Reduction:
Images for comparison to ideal

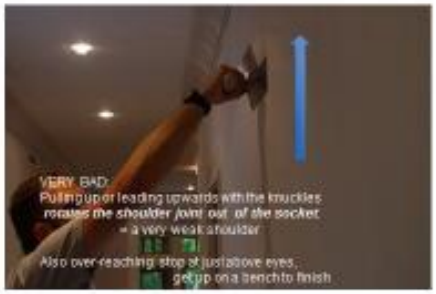
Shoulder blade supporting muscles weak or inactive causing the "points" to pop out- effectively weakening the shoulder joint

The right shoulder blade is activated and has pulled the right shoulder into a strong position (pulled down and into the center-spine)

There's a stronger way than this:

There's a stronger way than this:

There's a better way than this:



A much stronger way:

Palm of hand facing the direction of travel:

- keeps shoulder from rotating & popping out
- allows for larger muscles to be used (biceps instead of rotator cuff).

Bonus Points!
- hips and knees are also being used here to take the load off the lower back

There's a better way than this:

A much stronger way

Taper using body weight to assist in push across body (he can step into it)

Also: Prime mover chest muscles are stronger than the smaller rotator cuff stabilizer muscles

RWIP to Foremen

Project: To Create Indicators For Supervisors To Identify Potential MSIs

ultimate objective is to see a reduction in Time Loss MSI.
Time span of evaluation: 8 months.

Foremen/supervisors in risk identification not understanding objective of project	Probable	High	educate on cost/benefit, productivity issues associated with time loss; lost productivity due to injury impediments.
Worker not complying with recommendation to change movement/mechanics	Probable	High	Educate worker on need to comply, change; Incentives to comply; disincentives for noncompliance.
What is worker's experience: are there limiting factors to demonstrate correct movements, i.e. muscle imbalances, previous injuries restricting range of motion, not work hardened.	Probable	Med	Have workers assessed for functional capabilities;
Lost productivity for the jobs involved on the study: Increased labour costs due to breaks in work needed to explain to/correct workers, get feedback from workers	Very likely	High	A need to minimize down time during work stoppages. Create system of checks to allow for quick communication and feedback: provide workers with project objectives & guidelines; provide train workers in movements prior to project start.
worker is injured in the course of doing work.	Low likelihood.	low	safe jobs procedures

Indicators of potential injuries

Mechanics
Explanation of work related movements

- picking up sheet from rest to overhead
    - good and wrong way
        - Alignment of elbow under load while in "overhead press".
- trowel
    - internal vs. external shoulder rotation while wiping
        - alignment of elbow during shoulder rotation
    - overhead work
    - wall flats

application procedures, requirements, demands
tools
ergonomics
loads
postures
shoulder alignment
spine extension flexion
cervical spine
arm movements
shoulder rotation
position of elbow during shoulder rotation
changes in pace, productivity