Preface

• Difficult to quantify the upper limb demands associated with any work
• Difficult to analyze hand demands in repetitive multi-task jobs
• Even harder to establish relationship between a single task and MSD
• Seek to discover the underlying biomechanical relationship between work factors and disorders

Current Analysis Methods

Observational:
– TLV for HAL, RULA, Strain Index, Posture Targeting, OWAS

Instrumentation:
– Surface electromyography, motion capture, goniometry, accelerometers

• All methods better for monotask activity
• No one method easily or adequately addresses repetitive multi-task jobs

Repetitive Multitask Work

• Identification of peak task
• Estimation of rest periods
• Single value risk rating adequate?
• Quantification of differences between tasks?
• MSD related to a specific task or to the overall job?

Objective

• Development of an in-plant surface EMG method to assess task demands on the hand muscles in multitask work

Study Setting

• Automotive assembly
• Multitask jobs; 1 minute cycle
• Part of larger study examining the demand of flexible hose insertion tasks relative to other tasks in auto assembly
What is New About Surface EMG?

- Telemetric EMG and digital video recording technology
- Able to overcome one of the classic problems of in-plant data collection with instrumentation
  - What is the activity that corresponds to the recorded data?
  - i.e. ability to separate and manipulate data

Telemetric sEMG System

- Disposable surface electrodes; pre-gelled
- Snap leads hard-wired to pre-amplifier
- Cable to transmitter, data transmitted to receiver, uploaded to laptop
- LED to synchronize to video; EMG index

Procedure

1) Schedule personnel needs for plant visit
2) Obtain subject consent; take off line
3) Prepare skin, attach electrodes to finger flexors and extensors (FDS & ED)
4) Check for correct signal; secure wires
5) Perform maximal efforts for calibration
6) Return to line, synchronize to LED

Data Processing

- Examined video to record start/stop times for each task (divided as desired)
- Adjusted EMG data for noise and error in transmission
- Created Excel macros to perform synchronization

Sample Results

Typical Cycle of Bumper Bracket Install Low Job
Lube & Install Radiator Hose

System Limitations
- Information limited to muscles selected
- Sensitive to calibration exercise
- Between-worker comparisons
- Data processing intensive
- Environmental noise

Lessons Learned
- Management support
  - Plant awareness of activities
  - Forecasted replacement personnel if required
  - Encouragement of worker support
- Worker support
  - Clear explanation of activities
  - Non-threatening attitude
- Experimenter competency
  - Well-practiced and defined protocol
  - Ability to isolate desired muscle activity
  - Well-explained calibration procedures

Implications for Industry Use
- Relatively inexpensive and objective method for practitioners to document job demands
- Objective method to compare between task demands of multi-task jobs
- Measure of within-worker, within-task variability
- Measure of between worker, between task differences (%MVC)

Practical Utility
- Can determine task with highest demand
- Amount of 'rest' per cycle
- Ability to calculate HAL TLV from percent activation and durations of tasks
- Can describe sources of task variability
- High external validity
- Can show the effect of job changes

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