



MSI Prevention Guidance Sheet

Tools for Ergonomic Assessments

Purpose

Worksheets A and B, guidance sheets, booklets, and other publications about musculoskeletal injuries (MSI) refer to **force** and **awkward postures** as risk factors for MSI. Quantitative assessment of **force** and **awkward postures** requires special tools.

This guidance sheet describes two tools – dynamometers and goniometers – commonly used in research and in the field. It also describes how they are used to assess the risk factors of force and awkward postures.

Dynamometers

A **dynamometer** is an instrument used to measure force or power, especially muscular effort. The underlying mechanism in a dynamometer is usually a spring to be compressed or pulled.



Hand-held dynamometer (push/pull gauge)

Dynamometers, often referred to as force or strain gauges, are commonly used in physical therapy and rehabilitation. When used for injury prevention, a dynamometer typically measures pushing, pulling, or lifting forces. For example, a dynamometer can help determine if the forces needed to push or pull material are within the range normally considered to be acceptable or if they might be exposing the worker to a risk of MSI.

Dynamometers display readings in kilograms (kg), pounds (lb.), or newtons (N). Different kinds of dynamometers exist for use in different situations. One type of dynamometer can be used to measure small forces (1 lb. to 3 lb.) like those used for pinching motions. Others can be used to measure forces upwards of 100 lb., such as in manual material handling tasks.

Dynamometers can have a dial or digital type of display. Digital models may also provide such data management features as input memory/recall and the ability to download to a computer.

Other desirable features of dynamometers include a peak-hold needle (on a dial display), an adjustable grip handle, and tri-scale dual-scale readout (in newtons, pounds, and kilograms).

Because it is a sensitive and calibrated piece of equipment, a dynamometer can cost from several hundred to several thousand dollars. This is particularly true of the digital models featuring expensive technology.

Goniometers

A **goniometer** is a device used to measure joint angles or range-of-motion. In MSI prevention, a goniometer is used to measure range-of-motion (in degrees) of joints for either active or passive joint range. This is pertinent to functional reach and workplace design. Using a goniometer, an ergonomist can quantify posture, including measuring joint angles during performance of a task. Knowing the joint angle associated with a task can help ergonomists to make more specific design recommendations or to compare worker posture before and after changes have been made. A goniometer can also measure progress in return of range-of-motion during recovery.

A traditional goniometer is a protractor with extending arms. To use a goniometer:

- (1) Align the fulcrum of the device with the fulcrum or the joint to be measured
- (2) Align the stationary arm of the device with the limb being measured
- (3) Hold the arms of the goniometer in place while the joint is moved through its range of motion

The degree between the endpoints represents the entire range-of-motion.

Some software now exists for doing the same type of joint motion analysis, but its cost is many times that of a physical goniometer.



Typical manual goniometer

For more information

For more information on these tools and for answers to other ergonomic questions, please call:

604 276-3100 (Lower Mainland)

1 888 621-SAFE (7233) (toll-free in B.C.)