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Ergonomics of Hand Held Devices



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Occupational Health Centre

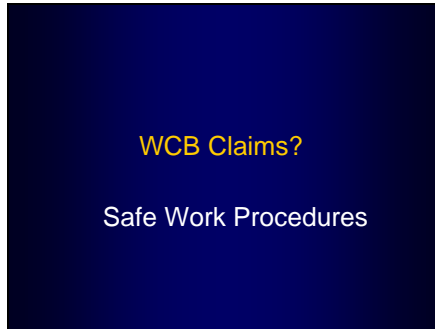
- is a community health centre funded by **Winnipeg Regional Health Authority** and donations.
- The Centre helps workers, employers, and joint health and safety committees to improve workplace health and safety conditions and eliminate hazards.
- Our services are available free of charge.

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Agenda

- Research Studies
 - Injuries and Findings
- Ergonomic Risk Factors
 - Anatomy, Injury Mechanisms
- Prevention Guidelines

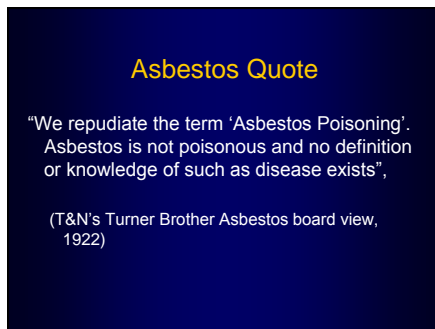
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Question: Does anyone know if the WCB has accepted a claim for an injury due to the use of hand held devices?

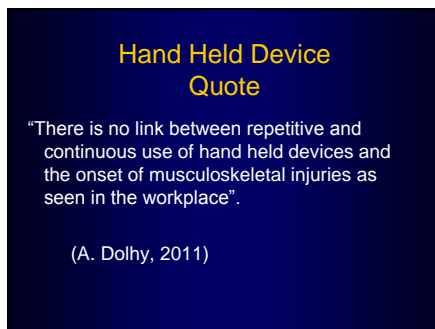
Would you need to develop a Safe Work Procedure?

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Our knowledge of the link between injury and exposure to asbestos was weak at that time. What about the link between hand held devices and injuries?

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Currently, there are clinical studies and only a few descriptive studies completed. Our knowledge of exposure and other risk factors is limited.

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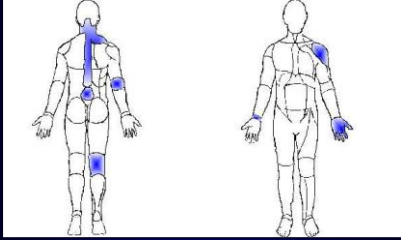
Scientific Knowledge

- Clinical Case Studies
- Descriptive Studies
- Epidemiological Research
- Intervention Studies

The survey that was emailed was similar to a recent University of Waterloo study looking at time of use. This is an example of a descriptive study.

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Areas of Discomfort



What areas of the body and or specific injuries can be related to hand held devices?

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Clinical Findings


- Osteoarthritis – CMC joint
- De quervains tenosynovitis – Blackberry Thumb
- Tension Neck Syndrome – muscle pain
- Forward Head Posture - Turtle necking
- PDA Nails -

From clinical findings, we have!

What is missing? – Carpal Tunnel Syndrome

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Osteoarthritis



- Continuous joint compression
- Cumulative effect
- Hand Held device = cause or aggravate

Note the location of the Carpo-metacarpal joint.

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De Quervain's Tenosynovitis



- **Tendons**
 - Long abductor
 - Short extensor

Compression and friction

These two muscles pull the thumb up and back.

This is known as texting thumb.

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De Quervain's Tenosynovitis

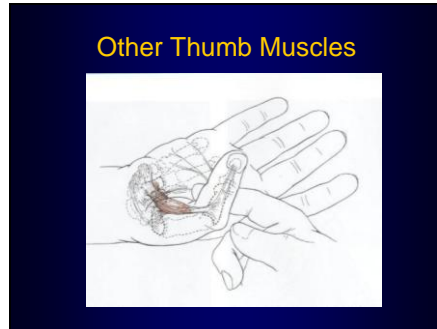


- **Tendons**
 - Long abductor
 - Short extensor

Compression and friction

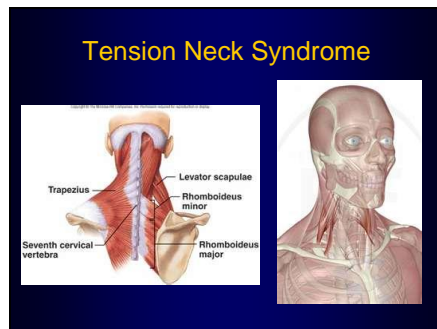
Note the location of the tendons – similar to the CMC joint!

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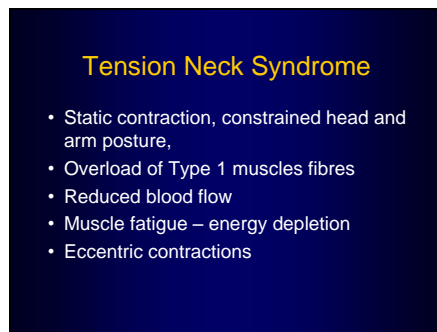
There are other small muscles in the hand to consider.

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Note the muscles at the back and front of the neck. These can become tight or stretched.

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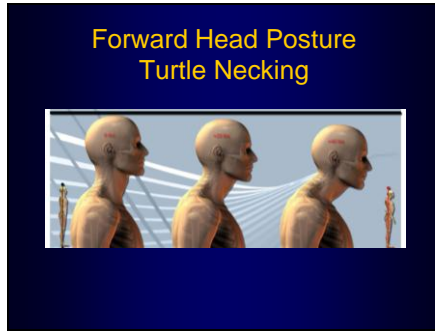


There are a number of injury mechanisms related to (and cause) neck muscle pain. All can be related to looking down while using a hand held device.

Tension Neck Syndrome

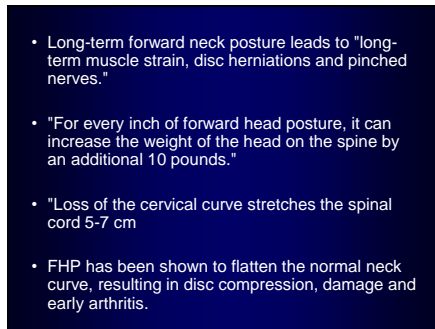
- Static contraction, constrained head and arm posture,
- Overload of Type 1 muscles fibres
- Reduced blood flow
- Muscle fatigue – energy depletion
- Eccentric contractions

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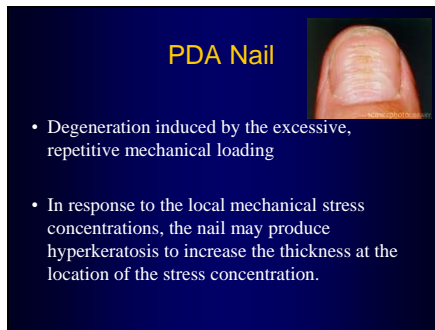
Have you heard of this injury?

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Here are some quotes/facts.

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One medical case study noted PDA nail due to overuse of a hand held device.

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Survey Findings

	Our Survey Hours / day	University Students and Staff
Daily Use Hand Held	2.6	4.7
Computer/laptop	6.1	8.2
Game controller use	0.5	1.2

Thank you for filling in the on-line survey.
Our un-scientific study results.

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Survey Findings

	Our Survey Hours / day	University Students and Staff
Email/Texting	2.1	1.0
Scheduling	0.9	0.3
Internet Browsing	1.2	2.2
Phone calls	1.2	1.0
Gaming	0.9	1.3

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MSI Symptoms

		None (%)	Moderate
Neck	Our	35	16
	University	32	26
Shoulders	Our	61	2
	University	38	16
Elbows	Our	77	4
	University	68	5
Hands (base of thumb)	Our	69	6
	University	72	8.5

Comparing no pain/discomfort and moderate pain/discomfort.

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University Study Findings

- All areas with pain was associated with total time spent on these devices.
- Osteoarthritis of the CMC joint rises with age. In this study pain at this joint was not age related.

Again, a descriptive study.

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Ergonomic Risk Factors



A cartoon illustration of a man in a blue suit and yellow tie, holding a mobile phone. He has a long, pointed nose and a slightly worried or focused expression. The background is white, and there is a small vertical copyright notice on the right side of the illustration.

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Ergonomic Risk Factors

- Equipment Fit
 - Anthropometrics
- Awkward Postures
 - Range of Motion
- Forceful Exertions
 - Internal Strain
- Static Loading
 - High Duty Cycle

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Anthropometrics
Thumb length 40-58mm.




- Vertical and 2 hands
- Horizontal and 2 hands - compensations
- Vertical and 1 hand – only large stature

Considering the hand and thumb lengths of a small female and a large male. How would you develop a safe work procedure for how to hold a hand held device? 'Compensations' refers to small thumb lengths where the worker would bend their wrists in order to reach the keys.

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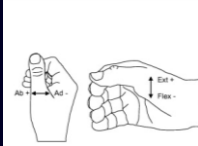
Postures of the Thumb

- What is an awkward posture for the thumb?



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Postures of the Thumb



Abduction = 30 degrees
Flexion = 45 degrees

What thumb posture(s) are missing?

Missing – opposition and circumduction.
The thumb joint is very complex. How do you measure the postures of the thumb? Therefore, how do you write a safe work procedure for this.

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Postures of the Thumb


- Subjects with symptoms:
 - had lower muscle activity levels in the abductor pollicis longus (1-1.5% MVC)
 - higher thumb movement velocities (12 degrees/second)
 - fewer pauses in the thumb movements (3.2 pauses/minute)

In another study, symptoms increased when the muscles were more static (same position for a period of time), the thumb speed was fast and there were fewer rest pauses for the thumb. How can we develop a safe work procedure based on this information?

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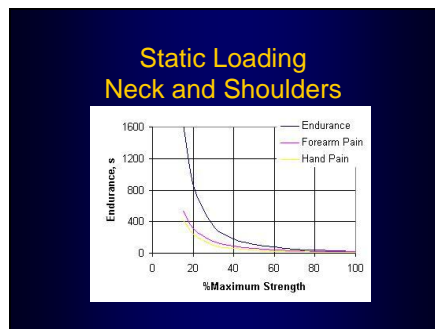
Postures of the Neck

- What do you think the flexion angle is for this neck posture?



Ergonomic Guidelines suggest >20 degrees is a risk factor!!!

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In this guideline, it appears that low force tasks on the neck and hands (holding onto a hand held device) can be accomplished for long periods of time!

These guidelines are for larger muscles groups and endurance.

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Static Loading Neck and Shoulders



- Pain starts at around – 290 sec and increases at around 320 seconds, Neck and shoulder posture.

It's around the 4-5 minute mark where people start to experience pain. It depends on the posture of the neck and shoulders and hands. There is no perfect posture, if the hands are low then the neck hurts, if the hands are higher up then the shoulders will hurt.

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Force / Pressure

- Ergonomics Guidelines suggest keys to be less than 2 Newtons of force.
 - With a neutral posture
- The internal force can be 3-4 times greater when in an awkward posture

Note: the internal force in the hands and joints can increase significantly if the posture is poor. Even if the outward force is the same.

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Continuous and Frequent

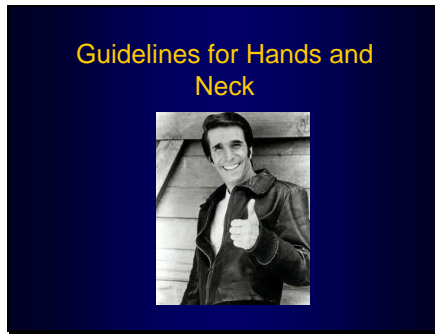
• Force	• Low
• Efforts per minute	• High
• Duration of exertion	• Low
• Posture	• Non-neutral
• Speed	• Fast
• Duration	• < 8 hours

Review of ergonomic risk factors and hand held devices. Our opinion is..... for each risk factor.

As a whole, or when you look at the combination of risk factors?

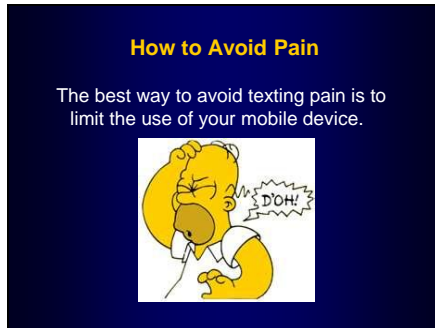
Do we have an issue with the use of hand held devices? How can we develop safe work procedures based on this knowledge?

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Is the hand held device a mobile office or a means of quick communication?

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Tips

- Posture – become very aware, neck and hands
- Shop around – consider weight and size
- When it hurts – stop
- Use as a reading tool – respond later on a computer or phone call.
- Keep messages short

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- Return only urgent e-mails on the PDA. Respond to other e-mails from your computer.
- Use key shortcuts (cut, paste, etc.) and abbreviations.
- Monitor the time spent on the phone or PDA.
- Take breaks to stretch and shake out the hands.

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- Alternate among using your thumb, index finger, and a stylus, if available.
- Use a different finger for the scroll wheel.
- Pay attention to your grip. Keep wrists upright and straight.
- Don't slouch while texting. Slouchers often develop neck pain, in addition to thumb pain.

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- Avoid typing for more than three minutes without a break.
- Insert it into a holder and set it on a desk or a briefcase.
- Decide that you will check emails and text messages just four times a day.
- Cut back on the number of keystrokes and keep messages short and simple.
- Rest your forearms on a pillow while typing to help minimize neck tension

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- Resources, articles and references
www.mflohc.mb.ca
Rural Safe Work Groups heading

Article on Hand Held Devices
www.working-well.org/articles/pdf/Handhelds.pdf

Occupational Health Centre newsletter
http://www.mflohc.mb.ca/newsletter_folder/2011/October_newsletter.pdf

For specific information on this or other studies, please contact Andrew Dolhy at the OHC
adolhy@mflohc.mb.ca

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- ### Future Considerations
- Video messaging
 - Voice commands – dictation and reading
 - Pre-defined messages

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Therapies!

