



Occupational  
Health Clinics  
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de l'Ontario Inc.

# When Technology Hurts

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# Presentation Overview

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- ❖ **Statistics**
- ❖ **Types of New Technology**
- ❖ **Challenges of New Technology**
- ❖ **Musculoskeletal Disorders**
- ❖ **Review of Literature**
- ❖ **Solutions**
- ❖ **What you can do**
- ❖ **Questions**

# New Technology





# Internet Use in Canada

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- Canadian Internet use is shifting from desktop Internet to mobile devices
- 3 out of 4 Canadians own smartphones and 49% of the time online is spent on mobile devices
- Social media is the top activity performed on portable devices
- Tablets have overtaken desktop computers as the preferred gaming platform
- The June 2014 Ericsson Mobility Report predicted there could be as many as 5.6 billion smartphone subscriptions globally by the end of 2019
- 1.3 million Canadians use only mobile devices to access the Internet

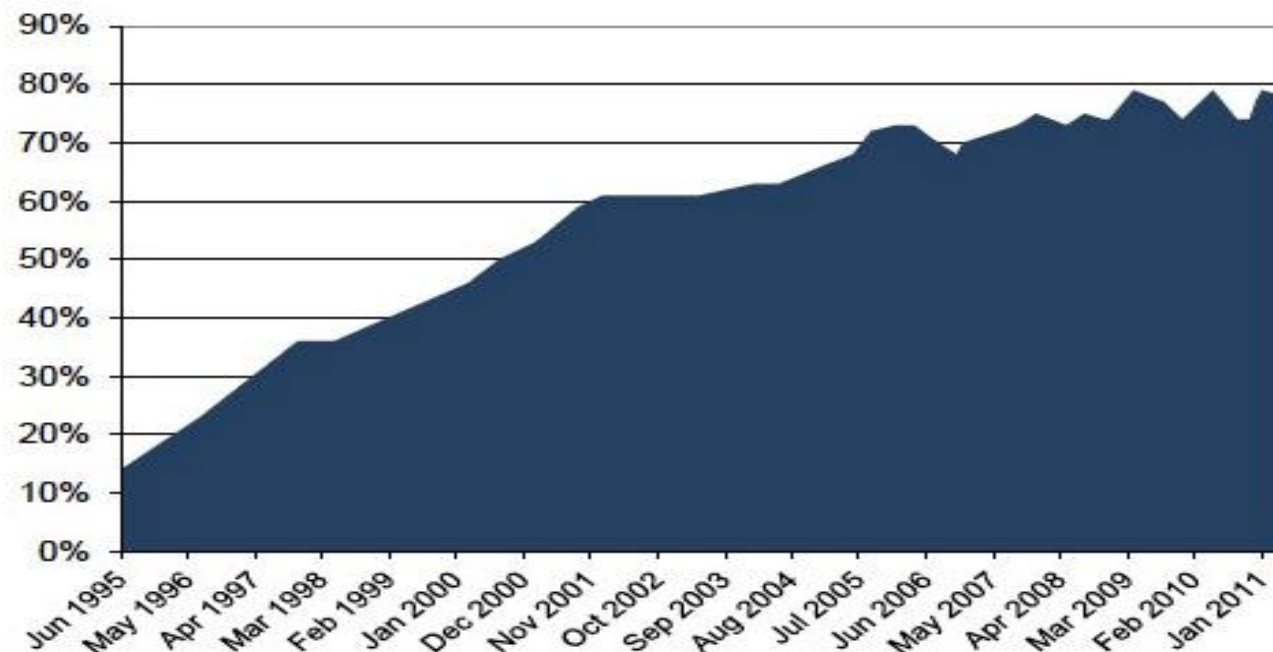
Source: Canadian Internet Registration Authority (CIRA),  
Factbook 2015



# Internet Use

## Internet adoption, 1995-2011

*% of American adults (age 18+) who use the internet, over time. As of August 2011, 78% of adults use the internet.*



Source: Pew Internet & American Life Project Surveys, March 2000-August 2011.

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# Laptop Statistics

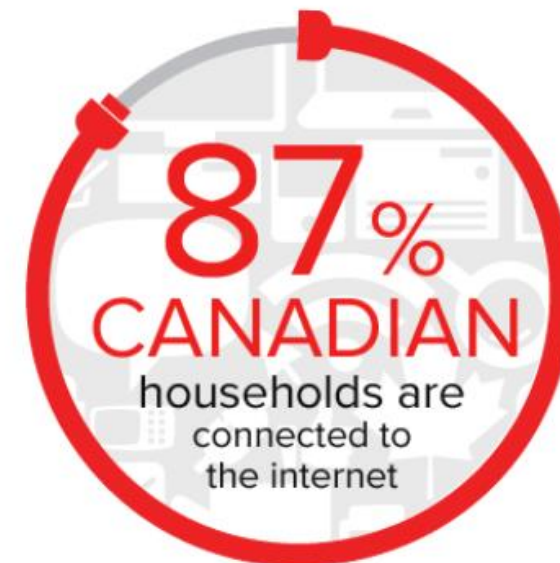
- Price gap between laptops and desktop computers has fallen to \$50
- 68% laptop usage in the workplace (mobility, small space, work from home)
- A lot of laptops now are incorporating a touch screen component to them





# Tablet & Smart Phone Statistics

- 2/3 of Canadians own a smartphone
- In 2014 49% of Canadians owned a tablet; up 10% from 2013
- 28.8 million Canadians are wireless subscribers
- More Canadians own cellphones than have land lines
- Canadians are consuming more data; each person averages 1 gig per month



Source: Canadian Radio-television and  
Telecommunications Commission (CRTC), October 2015



# What Does 1 GB of Data Look Like?

Data Usage	Amount
Surfing the Internet	44 hrs
Facebook	51 hrs
YouTube Videos	68 videos played
Email	34, 133 emails
Google Maps	17 hrs
Skype	4 hrs
Spotify	256 tracks



You **Tube**







# Implications

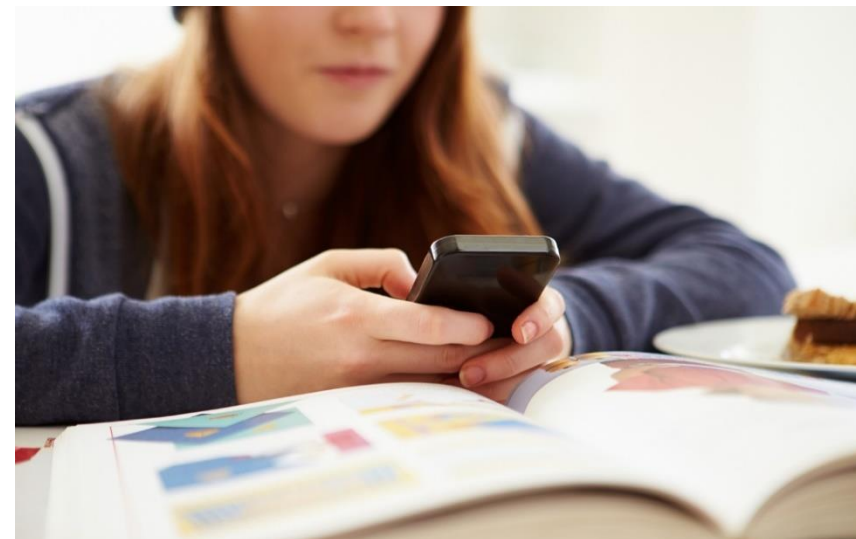
- Interaction with these devices is based on human body movement
- Cellphone, tablet and wireless technology is increasing the risk of musculoskeletal disorders
- Neck and shoulder pain is more prominent with the use of small devices
- Not taking into account proper positioning of these devices that were not designed for long duration use





# The Younger Generation

- Concerning for the younger generation because they use these devices much more frequently and could cause permanent damage
- College students with high smartphone usage are more likely than those with low usage to experience impaired hand function, thumb pain and other issues
- Increasing use of this type of technology in the school system from kindergarten to grade 12





# The Younger Generation

- Musculoskeletal discomfort has been associated with children using laptop computers with prolonged poor posture
- In this same study 26% of the children reported they would continue on with the task even when in discomfort
- Considerations for typing posture, keyboard height and workstation setup are not being considered at schools
- Children being exposed to prolonged poor postures during critical periods of skeletal growth

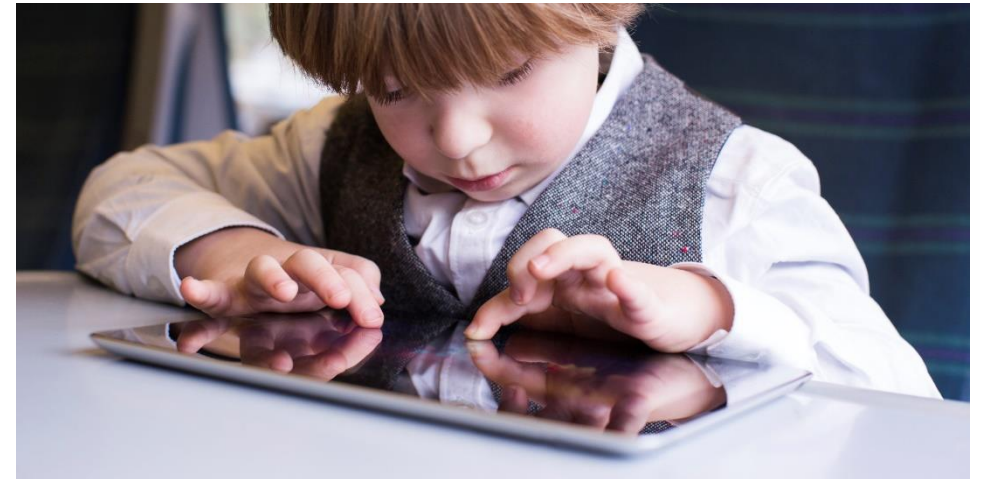


Source: Harris & Straker (2000)



# The Younger Generation

- Study compared tablet, desktop computer and paper tasks among children with a mean age of 5.6 years
- Measured 3D muscle activity around the neck and shoulder
- Tablet use was associated with more neck and trunk flexion, more flexed and elevated shoulders, and greater muscle activity around the neck



Source: Straker et al. (2008). A comparison of posture and muscle activity during tablet computer, desktop computer and paper use by young children. *Ergonomics*, 51 (4), 540-555.



# MSDs

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- MSDs related to cellphone and tablet use are on the rise due to the increased time spent on these devices; awkward postures, mechanical pressure, force exertion, repeated loading and duration of loading
- Most reported MSD associated with cell phone use is upper extremity muscle pain
- Common MSDs related to new technology:
  - Blackberry Thumb (de Quervian's Tenosynovitis)
  - Text Neck or IHunch
  - Cellphone Elbow (Cubital Tunnel Syndrome)
  - Eye Strain



# Areas of Discomfort

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## **Thumb:**

- The thumb is responsible for 50% of the function of our hands
- Circumduction, abduction and adduction; works in opposition to the fingers

## **Neck:**

- Long periods of excessive neck flexing can lead to fatigue and discomfort

## **Elbow:**

- Prolonged and static flexion of the elbows can lead to nerve compression

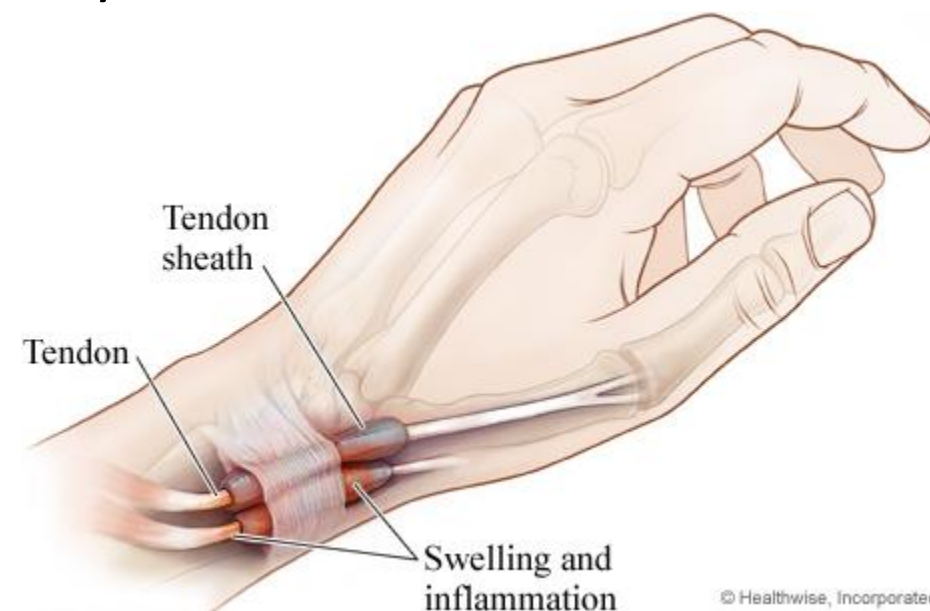
## **Shoulder:**

- Supporting the devices and reaching to the screen



# De Quervian's Tenosynovitis - Anatomy

- Thumbs were not designed for forceful, repetitive motions; they were designed to stabilize
- Tendons connect muscle to bone. Muscles pull on tendons for movement.
- Tendons are lined with a slippery coating called tenosynovium which is a sheath that allows the tendons to move back and forth evenly as the thumb moves to reduce friction.
- Inflammation of the tenosynovium is called tenosynovitis which limits the movement of the tendons within the tunnel.

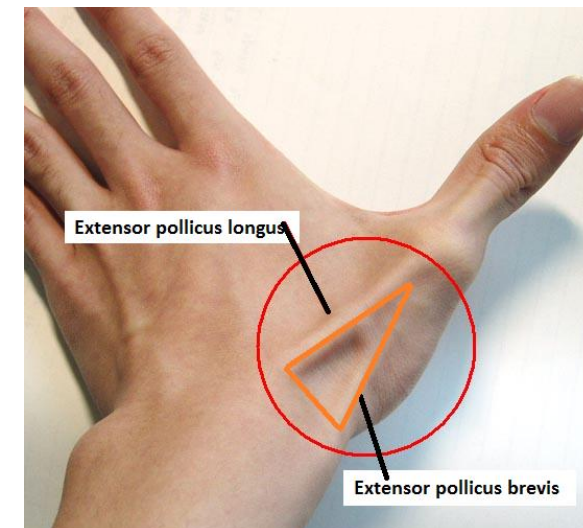




# De Quervian's Tenosynovitis - Symptoms

## Symptoms:

- Primary symptoms consist of pain, tenderness, or swelling over the thumb side of the wrist in the area of the anatomic snuffbox.
- Pain may spread up the forearm or further down into the wrist and thumb
- The tendons may actually begin to squeak as they move through the tunnel
- Performing abduction (moving thumb away from the hand) and extension of the thumb often worsens this pain.
- Strength of hand movements such as pinching and grasping are commonly diminished.







# De Quervian's Tenosynovitis - Treatment

## Non-Surgical

- A special forearm and thumb splint called a Thumbspica splint may be required to wear. This splint keeps the wrist and lower joints of the thumb from moving. The splint allows the APL and EPB tendons to rest, giving them a chance to begin healing.
- Anti-inflammatory medications can help control the swelling of the tenosynovium and ease symptoms.
- The doctor may suggest an injection of cortisone into the irritated tunnel if splinting does not work. Cortisone reduces the swelling of the tenosynovium and may relieve symptoms temporarily. Injections will reduce the inflammation in the early stages of the problem.
- Physiotherapy may also be required to reduce or eliminate the cause of irritation of the thumb tendons.





# De Quervian's Tenosynovitis - Treatment

## Surgical

- Goal of surgery is to give the tendons more space so that they no longer rub on the inside of the tunnel.
- A surgical release of the roof of the tunnel is required.
  - A small incision along the thumb side of the wrist.
  - The surgeon moves aside other tissues and locates the tendons and the tunnel.
  - Incision is made to split the roof, or top, of the tunnel. This creates more space for the tendons. The tunnel will eventually heal closed, but it will be larger than before. Scar tissue will fill the gap where the tunnel was cut. The skin is then stitched together and the hand is wrapped in a bulky dressing.





# iHunch or Text Neck

- MSD related to looking down at tablets, cell phones and other wireless devices for too long
- Strain on neck muscles increases 3-5 times when using a tablet compared to sitting with the head in neutral position
- Neck positions increase the mechanical loads in the neck





# Text Neck

- Average human head weighs between 10 and 12 lbs; shifting the neck forward 15 degrees increases the strain on the neck to 27 lbs

## The burden of staring at a smartphone

Effective weight on the spine as forward tilt increases

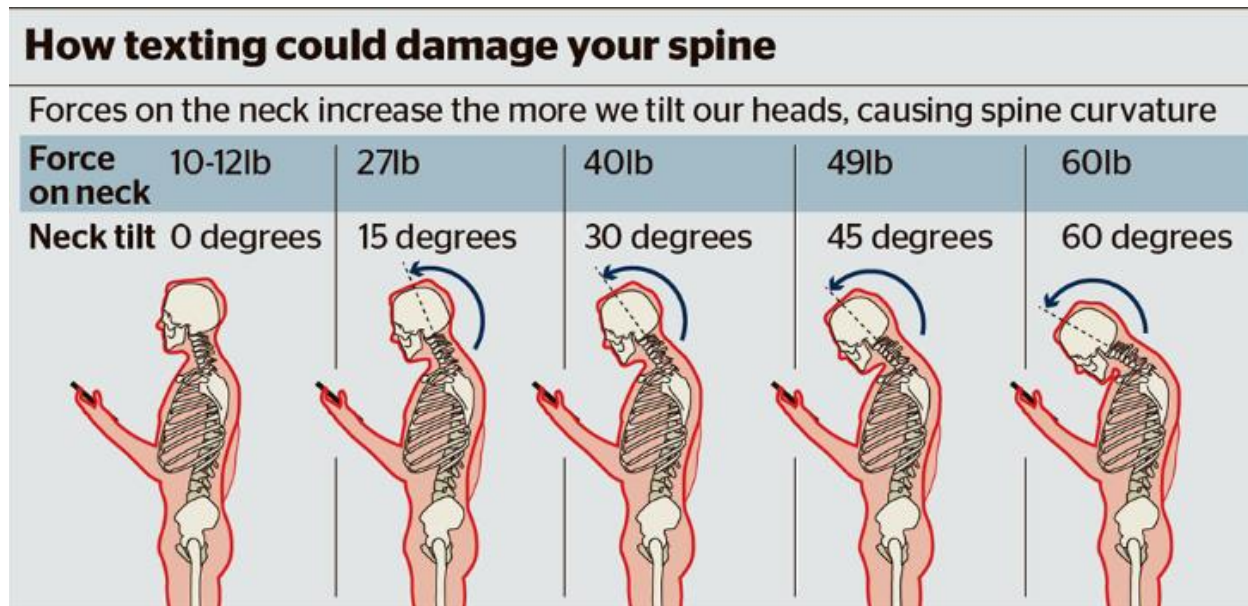
0° 12lb	15° 27lb	30° 40lb	45° 49lb	60° 60lb
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# Text Neck

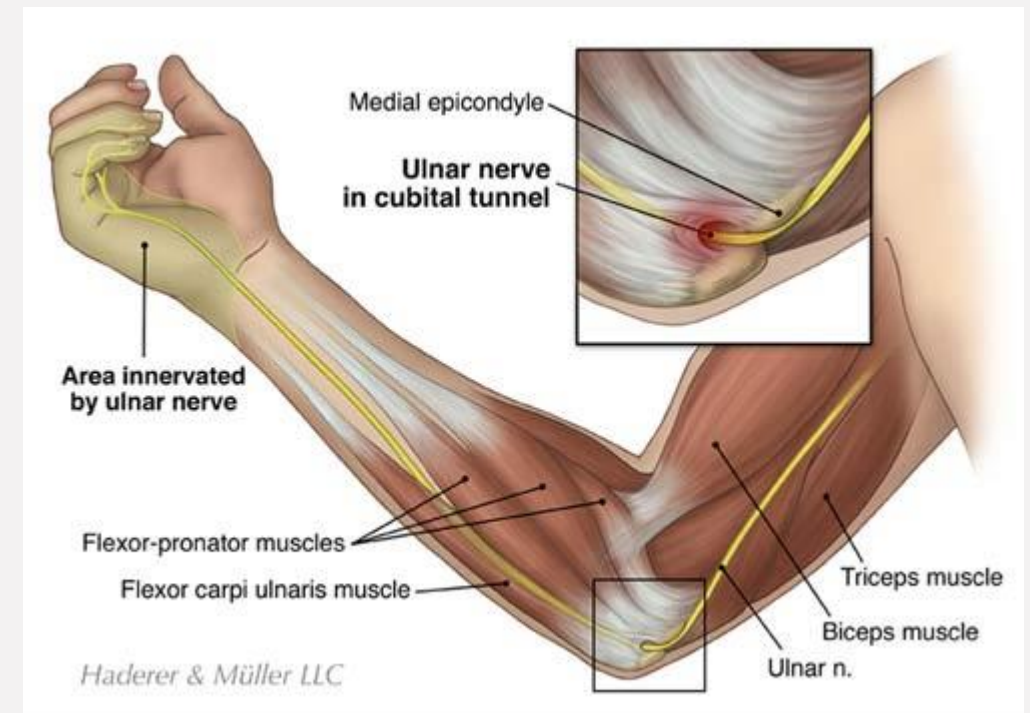
- Increases forces on the cervical spine
- 45 degrees is typical when texting
- Stretching your tissue for long periods of time causes them to get sore, inflamed and leads to muscle strain, pinched nerves, herniated discs and over time can remove the necks natural curvature



# Cellphone Elbow/Cubital Tunnel Syndrome - Anatomy



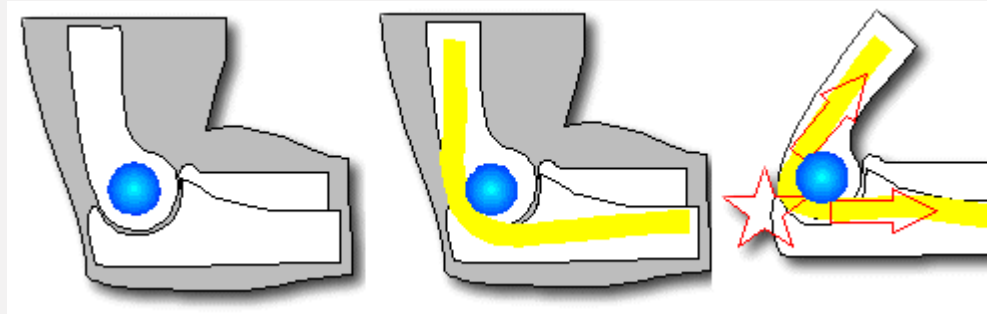
- Ulnar nerve starts at the side of the neck, where the nerve roots exit the spine through small openings between the vertebra called foramen.
- Nerve roots then join together to form three main nerves that travel down the arm to the hand. The ulnar nerve is one of those nerves.
- At the back of the elbow, the ulnar nerve passes through a tunnel of muscle, ligament and bone - the cubital tunnel.
- The nerve ends in the hand, supplying feeling to the pinky and half the ring finger.



# Cellphone Elbow/Cubital Tunnel Syndrome - Causes



- Caused by prolonged flexion of the elbow, and leaning on your elbow while talking on the phone
- When the elbow is bent, the nerve may be stretched and push against the elbow.



- The ulnar nerve actually stretches several millimeters when the elbow is bent.



# Cellphone Elbow/Cubital Tunnel Syndrome - Symptoms



- numbness, tingling in the little finger and outside of ring finger
- pain in the elbow
- Symptoms may worsen to hand fatigue and weakness, difficulty gripping, curling of the pinky and ring finger



# Cellphone Elbow/Cubital Tunnel Syndrome –

## Conservative Treatment



- **Anti-inflammatories** - to help reduce swelling around the nerve.
- Although steroids, such as cortisone, are very effective anti-inflammatory medicines, steroid injections are generally not used because there is a risk of damage to the nerve.
- **Bracing or splinting.** - a padded brace or splint to wear at night to keep your elbow in a straight position.
- **Nerve gliding exercises.** Some doctors think that exercises to help the ulnar nerve slide through the cubital tunnel at the elbow and the Guyon's canal at the wrist can improve symptoms. These exercises may also help prevent stiffness in the arm and wrist.

# Cellphone Elbow/Cubital Tunnel Syndrome – Surgical Treatment



- ***Surgical Treatment***
- **Cubital tunnel release.**
  - The ligament "roof" of the cubital tunnel is cut and divided. This increases the size of the tunnel and decreases pressure on the nerve.
  - After the procedure, the ligament begins to heal and new tissue grows across the division. The new growth heals the ligament, and allows more space for the ulnar nerve to slide through.
  - Cubital tunnel release tends to work best when the nerve compression is mild or moderate and the nerve does not slide out from behind the bony ridge of the medial epicondyle when the elbow is bent.
- **Medial epicondylectomy.**
  - Removes part of the medial epicondyle. Like ulnar nerve transposition, this technique also prevents the nerve from getting caught on the bony ridge and stretching when your elbow is bent.



# Eye Strain

- Computer Vision Syndrome (CVS)
- Affects 50%-90% of computer, smart phone and tablet users and is expected to grow as more people begin using these devices
- We hold digital devices closer to our eyes than books
- Eyes constantly need to re-focus and work harder in order to focus on tiny font sizes and images
- Blink less often when staring at a computer screen (typically blink 18/min but with computer use only half this, so eyes are not getting re-coated with tear film)
- Symptoms: tired, dry, itchy, blurred vision and burning eyes





# Literature

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- Chiang & Lio (2016) investigated the use of tablets and the variations of neck posture associated with different tablet tilt angles and the association of tablet use with users' MSD discomfort
  - Tablet use is associated with increased neck discomfort
  - Steep tilt angles (60°) may cause tablet users to decrease their head and neck flexion leading to more neutral postures
- Young et al. (2012) investigated head and neck postures when using 2 media tablets in 4 common user configurations,
  - Head and neck postures during tablet computing can be improved by placing the tablet higher to avoid low gaze angles and through the use of a case that provides optimal viewing angles



# Literature

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- Yong et al. (2013) assessed postures of the shoulders and wrists as well as their associated muscle activity during touch screen tablet use
  - Touch-screen tablet users are exposed to extreme wrist postures that are less neutral than other computing technologies and may be a greater risk of developing MSD symptoms.
  - Tablets should be placed in cases or stands that adjust the tilt of the screen rather than supporting and tilting the tablet with only one hand



# Cellphone Screen Size

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Apple has unveiled iPhone SE, its first 4-inch smartphone since 2013. As the company says, “this light and compact phone is designed to fit comfortably in your hand.”

Steve Jobs famously believed phones should match the ergonomics of your hand. In 2010, as competitors were selling larger devices, he mocked a big phone: “You can’t get your hand around it... No one’s going to buy that.”


<https://www.youtube.com/watch?v=O99m7lebirE>

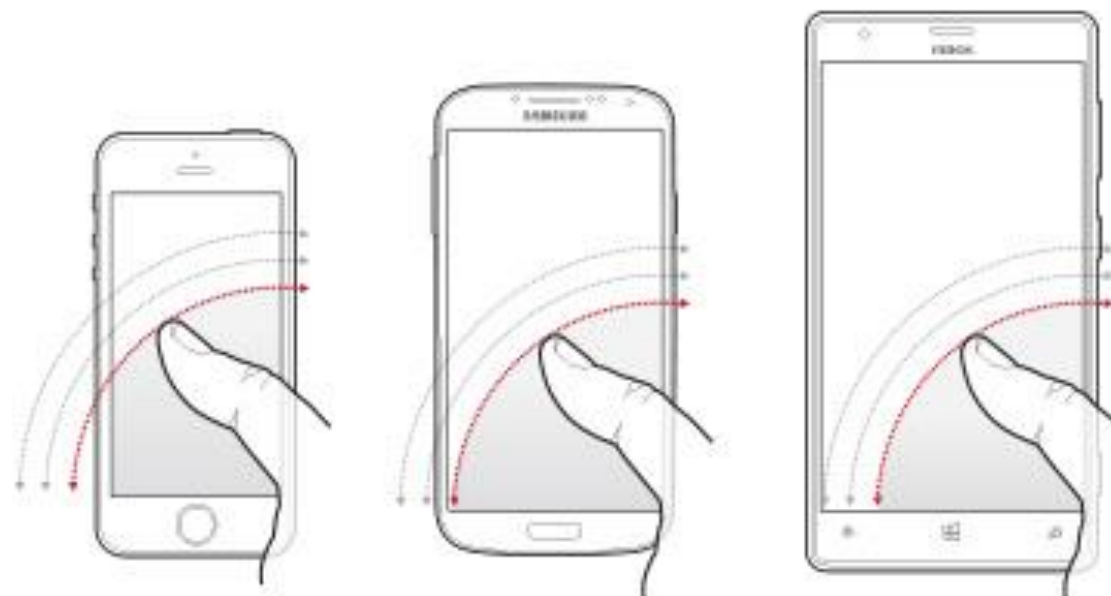


# Cellphone Screen Size

## 3 Factors to Consider:

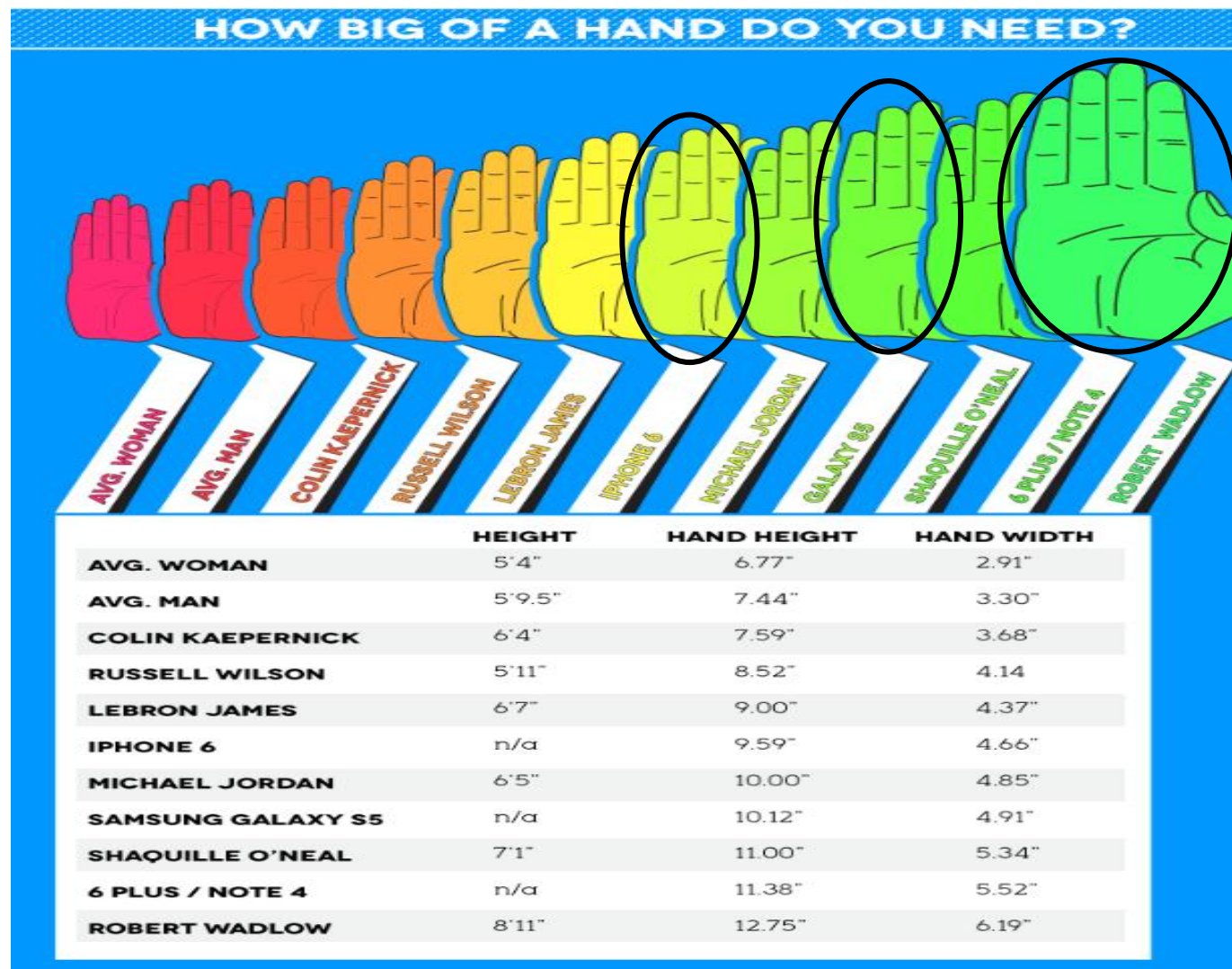
- What you can see
- What your thumbs can reach
- What can you comfortably hold

 Does Your Hand Fit Your Screen?





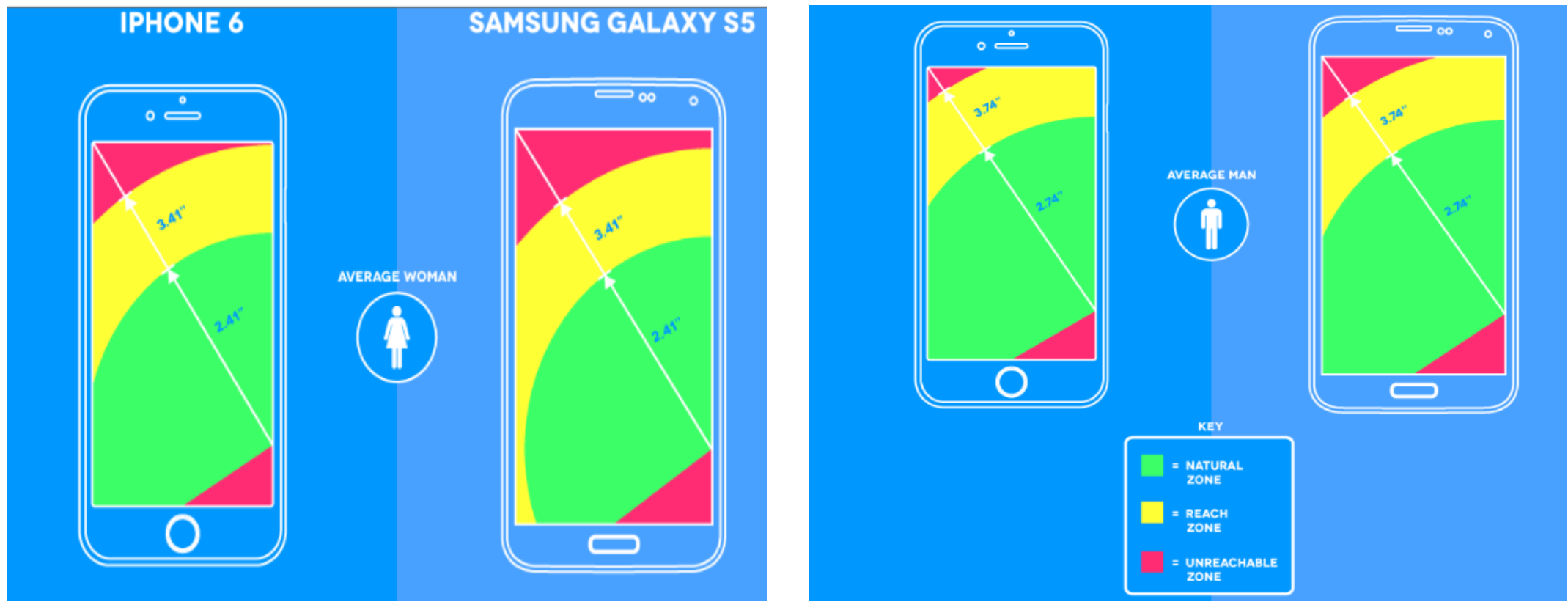
# Hand Size





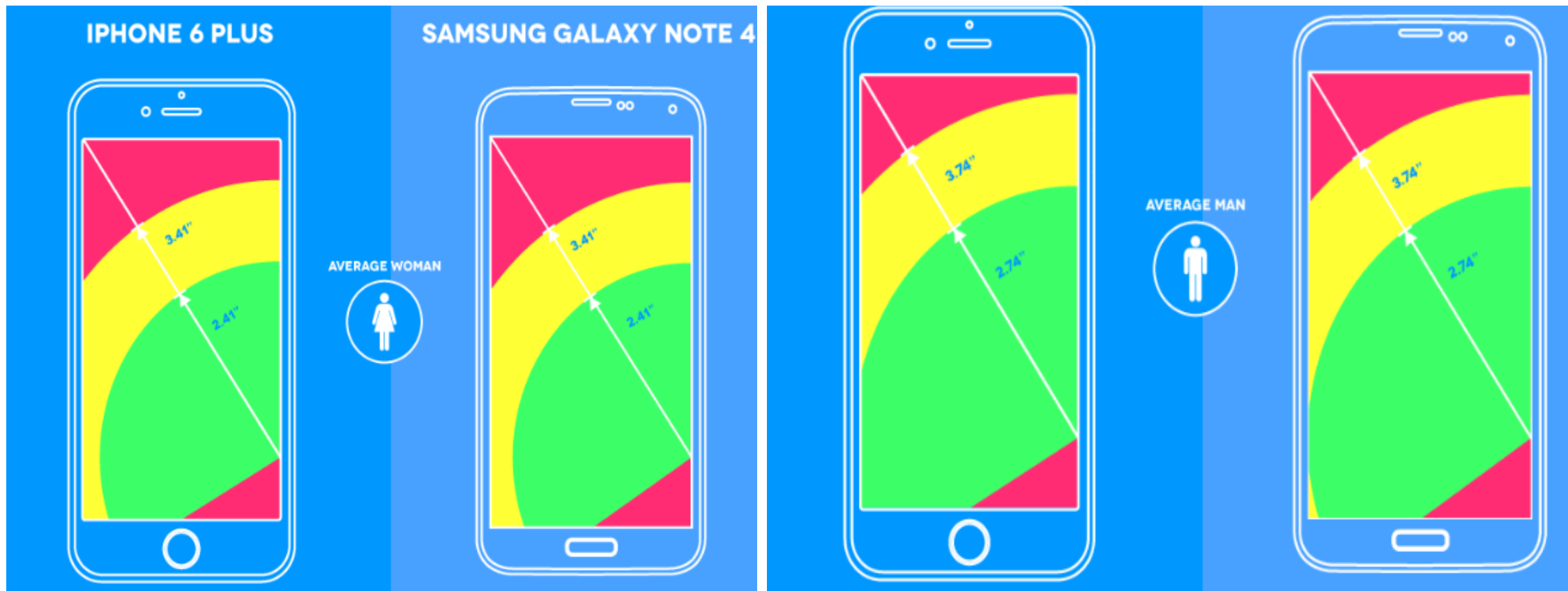


# Cellphone Screen Size





# Cellphone Screen Size





# Cellphone Solutions

We need to learn how to use them better:

- Start paying attention to how you use your phone and how often.
- Make an effort to bring your phone up to **eye level** instead of always bending your head down.
- Get to know the **voice activated features** so you can take your eyes off the phone.
- Use **earbuds** with a speaker to free your head from your phone.
- Do neck and shoulder **exercises** to keep your neck mobile.





# Laptop Solutions

- Use external input devices (keyboard & mouse)
- Use a laptop stand
- Adjust font size on the screen
- Docking Station





# Tablet Solutions

- For Prolonged use synch your tablet with your desktop or laptop computer
- Use Bluetooth external devices: keyboard and mouse
- Use an inline document holder if referring to documents on your tablet
- Universal Tablet Cradle by Ergotron





# Tablet Solutions





# Classroom Solutions

- Straker et al. (2010) presented guidelines for appropriate physical development of children using computers
  - Take a break from computer tasks every 30 minutes
  - Use active input devices whenever possible
  - Be encouraged to move around and periodically alter their position

\* Proper workstation setup based on the Anthropometrics of the population that is using the devices





# What can you do?

- Take a break
- 20-20-20 rule: to reduce eye strain, every 20 minutes look about 20 ft ahead for 20 sec
- Change your position
- Bring device closer to eye level
- Stretches





# Questions

