

Prisoners of Handhelds: Tips for avoiding injuries

By Tamara Mitchell
Edited by Sally Longyear



Handheld devices are being used for communication, computing, organizing our lives, playing games, taking pictures, and listening to music. They are changing and merging technologies at lightening speed. These handheld devices are an important part of many people's lives due to their capabilities and their portability. Now even children are being asked to use them! Unfortunately these devices are tripling the risk for Repetitive Strain Injury (RSI) associated with technology: 1) Computer input devices (i.e., mice and trackballs), 2) laptops, and now 3) handheld devices contribute to the development of potentially disabling RSI, more accurately classified as Cumulative Trauma Disorders.

Use and Design Nightmares

Awkward posture, a tight grip and repetition stresses muscles, tendons and ligaments, and causes discomfort associated with muscle tension.¹ If the tension is not released, soft tissues become permanently damaged and nerves are impacted.



These stressful activities are common among smartphones, PDAs, cell phones with messaging, pocket PCs, and other handheld devices.

“Handhelds” require awkward hand positions while performing repeated motions on tiny keypads. Thumb messaging is extremely stressful to muscles and ligaments. PDAs also involve gripping a tiny stylus to mark on a display that is often too small to be easily read.^{2,3}



In addition, to view these very small devices, users are in a hunched-over position with a bent neck, stooped shoulders, and a rounded back. This position adds up to 150 pounds of extra force on the back, neck and shoulders.

Cell Phones

Cell phones add to the risk of RSI if you clench them between your ear and your shoulder. They are even harder on your neck than regular phones because they are smaller and thinner, causing more neck flexion.

Ergonomic design appears to be an afterthought for cell phone makers.⁴ Most companies are technology driven and have little or no concept of the principles of human factors and ergonomics and how to integrate them into product design.⁴ Motorola claims to have a team of ergonomists and human factors designers, however there is no product on the market that is simple and intuitive to use, with manual dexterity and strain-free design.⁴ In fact, there's probably more money to be made selling complicated cell phones that squeeze a lot of functionality into a small space.⁵ Unfortunately, consumers are not asking for a phone that is also an MP3 player, a camera, and a voice recorder; they are asking for better usability.²

Two thumbs down on text messaging.

Physiotherapists are recognizing that too much text messaging can result in pain and swelling of the tendons at the base of the thumb and wrist, now termed Text Messaging Injury, or TMI.^{6, 7} The thumb is good at grasping, but it is not very good at repetitive movements. Small, fine movements tend to cause more irritation than larger movements and, since devices are getting smaller, the buttons are more difficult to activate.⁶

Text messaging, or texting, is a relatively new activity and repetitive strain injuries develop over time, so documented cases of TMI are limited.⁷ The biggest sufferers are college students and young adults who chat online, use text messaging, and play video games extensively.⁶ The problem is also seen in adult users who feel compelled to answer business emails "24/7" to stay on top of overwhelming workloads.⁸

Technological Solutions

Cell phones

A few companies are trying to decrease the stress associated with typing on cell phones:

- Eatoni Ergonomics has developed predictive text entry software that reduces the number of repetitive keystrokes.² It can be used with any cell phone utilizing a Symbian operating system. Several Nokia phone models are labeled for use with the QWERTY keypad layout and come with the Eatoni software. The software can be downloaded for \$15 from Handango.com. It has three different modes with various levels of predictive software. It requires a bit of ingenuity to get used to the QWERTY keypad rather than the typical ABC phone key layout.^{9, 10}

- Another manufacturer has devised a keypad called Fastap.¹¹ It intersperses separate letter keys with the number keys. Dr. David Levy, the inventor of Fastap, was the head of Portable Device Ergonomics at Apple Computer for five years. He claims the design is extremely intuitive and simple, so any user can pick it up and use it. Problems exist, however, because phone manufacturers are slow to buy into new designs that are not technology driven.¹² Telus Mobility, a Canadian company, supplies a phone fitted with the new interface. It reports that sales are outstripping its other lines in the first six months on the market.¹²



Smartphones

The newer smartphones are often designed as a clamshell device that opens up to a full color monitor and QWERTY keyboard. This design enables easier typing with two to three fingers for people with smaller hands when the keyboard is lying flat, or with two thumbs for larger hands and typing in-air. The inclusion of a standard keyboard is a safer alternative to the phone keypad because it decreases the number of repetitive motions required for alphanumeric entry, but it still overtaxes the use of the thumbs, and the keys are too small for many adult hands.



Verizon LG VX9800



Nokia 9500

PDAs

While looking at reviews of PDAs, we were disappointed to see that the HP iPAQ was considered “definitely an ergonomic PDA” because it was slightly curved and had rubberized sides for better grip.¹³ It is good that the product requires less gripping force to hold, but what else makes it “ergonomic”? It still requires entry with a miniscule stylus.

Some PDAs now have keyboard entry rather than stylus entry (e.g., the Blackberry), but these increase RSI risk due to small keys and thumb typing.



Blackberry 8700c

Input improvements

Keyboards

External keyboards are available for use with PDAs and wearable PCs, but are often not used because the addition of carrying and plugging in an external keyboard defeats the purpose of having a very small mobile device. It should be noted, however, that there are many foldable keyboards that fold down to a pocket-size. These keyboards cost less than \$50 and should be considered if a handheld device is used extensively. Unfortunately, problems exist with the use of these keyboards because they attach directly to the PDA.

This requires users to hold their head down to see the display (a posture called “turtlenecking” by Vivienne Fleischer, co-founder of Performance Based Ergonomics.⁸⁾



Targus



Adesso



Palm

Another small, lightweight alternative is the FrogPad, a wireless Bluetooth one-handed keyboard that can be used with laptops, wearable PCs or Macs, PDAs, or mobile phones.¹⁴ It measures just 5 x 3.5 x .4 inches, has standard sized keys, and weighs 4.9 ounces. It does require a bit of learning to use, but is a great solution for typing on small, wearable devices, especially for people with large fingers.



Courtesy of www.frogpad.com

The letter layout is based on the percentage of usage of each letter in the English language and was designed with the natural drumming motion of the hand. Once this technique is learned, typing speeds increase significantly. It is available in either left- or right-handed models. The best feature of this solution is that it’s wireless, so the handheld device can be set at the correct viewing height while the keyboard is held at the appropriate typing height. Please see the workstation design web page for correct heights (http://working-well.org/wkstn_design.html).

Stylus

More user-friendly than the typical stylus are multifunction pens that contain a pen, pencil, and stylus in an easy-to-hold instrument with a padded grip.



Papermate 3-way pen/pencil/PDA stylus

Digital pens

Handwriting is still often the most comfortable way to input data. Most PDAs allow “graffiti input” (generally block lettering, one letter at a time) on the screen, which is recognized and

works pretty well, although rather slowly.^{15, 16} There are also digital pen systems that convert pen strokes into digital data (e.g., Logitech IO).^{17, 18} Teamed with software such as the XMS digital pen platform, the digital pen can input to a PDA or other device, fill in PDF forms, sign documents, and perform almost all functions that can be accomplished with a keyboard or stylus.^{17, 19} The early pens were very bulky and required writing on a special paper, but it appears that both the size of pens and the requirement for special paper may be a thing of the past.



Logitech io2 Digital pen

Voice recognition/recording.

Internet providers are now beginning to offer email by phone options.²⁰ Using text-to-speech technology, you can have your email read aloud on your cell phone from multiple email accounts and you can compose response emails either by using the WAV file attachments to an email with your voice reply or you can reply with voicemail.²⁰ Earthlink offers this service now for only \$4.95 a month. Other Internet providers are probably going to follow soon.

Display magnifiers

To help you see your PDA display better, there are screen magnifiers that snap onto the display. Some are designed for a specific model, but there are magnifiers that adjust to fit any PDA. As pictured, Office On The Go “Magnifico” PDA Screen Magnifier sells for \$30.²¹



Solutions for kids

If you're worried about your kids, consider purchasing a cell phone designed just for them.²² These phones allow only voice calls. Kids cannot download ringtones, send or receive text messages and email, take pictures, surf the net or check voice mail.²² They have only a few pre-approved and preprogrammed numbers. There are only three options right now: Toys R Us TicTalk, Verizon Migo, and Cingular Firefly.



Toys R Us Tic Talk



Verizon Migo



Cingular Firefly

More companies are developing kid phones such as Mattel's Barbie cell phone and Hasbro walkie-talkie system with a 2-mile radius.²² A very cool concept has been slow to make it to the

marketplace is the hop-on Chitter-Chatter phone which is worn like a wristwatch, has few simple buttons you can preprogram, a 911 button and a locator button that sends the user's location so anyone with internet or phone SMS capabilities can identify the location of the device.²³

Self-Care Solutions

While it's hopeful to see that there are possible technological solutions to some of the problems encountered with handheld devices, there is still the issue of overuse. Users need to be aware of their limits and to take care of their bodies. RSI can occur with any tool when used too long in an awkward position. Follow these tips to minimize your risk of a serious, painful disorder for which there is no cure:

Never cradle the phone. Either hold the phone or use an earpiece, microphone, or headset.¹ If you can't use a headset, consider alternating ears for each conversation or every ten minutes for long conversations.¹ Changing sides will distribute the stress more evenly and give each ear and hand a chance to rest.¹

Limit messaging and typing. Risk of injury associated with messaging is similar to pipetting in terms of the strain to muscles and tendons. One of the best solutions for avoiding injury is to limit the time you spend on a cell phone or PDA.¹ Ergonomists recommend limiting messaging to no more than 1½ hours in a 24-hour period.⁷ People should use PDAs for information retrieval and reading, and should limit messages to very short sentences (e.g., the equivalent of Post-It Notes).⁷ When you must enter data, use a comfortable keyboard and big screen on a larger computer, then synchronize with your PDA.³

Stop when it hurts. Small muscles tire quickly, so stop and give your hands a break.⁷

Do some stretches. Warm up hands by doing some stretches. Stretches should never be painful. If you feel pain, consult a doctor.⁸ During the day and while sitting at a red light or in traffic, stretch the wrist backward for 2-3 seconds, then forward for 2-3 seconds.^{8,7} Spread your fingers as wide apart as you can and hold them for 2-3 seconds.⁷ Tuck your chin in and make a double chin; hold for 2-3 seconds.⁷ Fold your hands together and turn your palms away as you extend your arms forward.⁸ See the stretches webpage for pictures of stretches (<http://working-well.org/stretches.html>).

Be aware of your posture. Keep your shoulders relaxed, away from your ears.⁸ Do not contort your body to read messages; take the device off your belt to read it.

- Bring the device into your field of vision
- Keep the device 90 degrees perpendicular to your fingers when you press the buttons.
- Hold the device below your heart.
- Keep your back straight

Use two hands to type and reduce your grip. Don't hold the device in one hand and type with your thumb. Use two hands. Hold the device lightly in one hand and use the index finger of the other hand to type. While using a PDA, hold the stylus as lightly as possible.

.....

This article and all of our articles are intended for your information and education. We are not experts in the diagnosis and treatment of specific medical or mental problems. When dealing with a severe problem, please consult your healthcare or mental health professional and research the alternatives available for your particular diagnosis prior to embarking on a treatment plan. You are ultimately responsible for your health and treatment!

.....

REFERENCES:

1. Cell Phone Ergonomics. Mobile Ergonomics: Safety for People on the Go, ©2002, HealthyComputing.com, Inc. <http://www.healthycomputing.com/mobile/phone/>
2. Cell Phones Turn 30, But Ergonomically Are They Still In the Dark Ages? ©2006 Ergoweb, Inc., April 4, 2003. <http://www.ergoweb.com/news/detail.cfm?id=712>
3. PDA Ergonomics. Mobile Ergonomics: Safety for People on the Go, ©2002, HealthyComputing.com, Inc. <http://www.healthycomputing.com/mobile/pda/>
4. Cell Phone Design Given a Failing Grade for Usability. ©2006, Ergoweb, Inc., August 15, 2005. <http://www.ergoweb.com/news/detail.cfm?id=1177>
5. Ergonomics and Usability of the Incredible Shrinking Cell Phone. ©2006, Ergoweb, Inc., July 27, 2005. <http://www.ergoweb.com/news/detail.cfm?id=1164>
6. Two Thumbs Down to Increased Texting Among Teens, ©2006 Ergoweb, Inc., Sept. 5, 2005. <http://www.ergoweb.com/news/detail.cfm?id=1188>
7. All Thumbs: The Ergonomics Implications of Text Messaging. ©2005 Herman Miller, Inc. http://www.hermanmiller.com/hm/content/research_summaries/wp_AllThumbs.pdf
8. Handheld Hurt: Small Electronic Devices Like a Blackberry Can Be A Royal Pain in the Fingers. By Nichole C. Wong, ©2005 San Jose Mercury News, Feb. 28, 2005.
9. Eaton Ergonomics, EQ3 Email. http://www.eatoni.com/wiki/index.php/EQ3_Email
10. EQ3 Email. <http://www.handango.com/PlatformProductDetail.jsp?siteId=1&platformId=4&N=7&productId=178708&R=178708>
11. Fastap – Fastap by DigitWireless. <http://www.digitwireless.com/index.html>
12. Keypad Usability Expert Designs for Faster Text Messaging. ©2006 Ergoweb, Inc., September 23, 2005. <http://www.ergoweb.com/news/detail.cfm?id=1197>
13. PDA Reviews: HP iPAQ hx2750 Pocket PC Review, by Lisa Gade, January 4, 2005. http://www.mobiletechreview.com/iPAQ_hx2750.htm
14. FrogPad, Inc., 3310 W. Main, Houston, TX 77098, 1(713)960-9611. \$80-\$130 (depending on color selection). www.frogpad.com,
15. Palm vs. Pocket: which one is for you? By Lisa Gade, updated June 2004. http://www.mobiletechreview.com/tips/palm_vs_pocketpc.htm
16. Graffiti lets you scribble away. By Ed Curran, CNN.com/career, March 7, 2001. <http://archives.cnn.com/2001/CAREER/goodgadgetry/03/07/typos/>
17. The power of paper. <http://www.penvision.se/penvision.se/paper.html>
18. Logitech® io™2 Digital Writing System <http://www.logitech.com/index.cfm/products/features/digitalwritingtopics/US/EN,CRID=2095,parentCRID=1545,contentID=9246>
19. DigiPens for the Write Market. Dec. 21, 2002. by Michael Stroud. <http://www.wired.com/news/gizmos/0,1452,56951,00.html>
20. Earthlink Email by Phone. <http://www.earthlink.net/dialup/extras/ebp/>
21. On The Go Magnifico PDA Magnifier. Datavision.com <http://www.datavis.com/webapp/commerce/command/ProductDisplay?prfnbr=442566&prmenbr=2000>
22. Cell Phones for the Elf League. 2006, Ergoweb, Inc., December 26, 2005. <http://www.ergoweb.com/news/detail.cfm?id=1243>
23. Wireless GSM Cell Phones. Chitter-Chatter Kids Phone. <http://www.hop-on.com/kidsphone.html>