

ASSISTIVE TECHNOLOGY

Assistive technology (AT) is “any item, piece of equipment, software, or product system that is used to increase, maintain, or improve the functional capabilities of persons with disabilities” as defined by the Assistive Technology Industry Association (www.ATIA.org). There are three primary goals of the use of assistive technology for persons with SCI:

1. To provide an optimal level of functioning including independence.
2. To increase the individual’s autonomy and minimize the need for caregiver assistance.
3. To promote satisfaction with function and a high quality of life, whether it is at home, in the workplace, or in the community.

Assistive technology can refer to any piece of equipment, low tech or high tech, that helps someone to function more independently. For the purposes of this chapter we will focus on technology that helps individuals with SCI/D access and participate meaningfully in their environment. The most functional AT option for a user is not necessarily based on their level of injury. Assistive technology selection must be based on ease and speed of use, user preferences, user stamina or fatigue, and prevention of repetitive strain injuries. Often, a mix of products will be used to create the most effective solution. Working with an interdisciplinary therapy team, an Assistive Technology Practitioner (ATP), researching online, and networking with peers with SCI/D can help identify potential product solutions. You can find a directory of ATP’s online at www.resna.org. Assistive technology may not be reimbursable by certain insurers. However state-funded grant programs and low cost loans are available. Furthermore, solutions that are designed for the general population may offer lower cost options than specialized medical/rehabilitation equipment.

In this chapter we will discuss common assistive technology options. Please note that products shown in this chapter do not represent product endorsements, but serve as examples of an array of available technologies. Assistive technology is a

rapidly evolving field. While this chapter provides the best summary available at the time of printing, it is wise to search the internet for new, emerging technologies.

ENVIRONMENTAL CONTROL

Historically, the best way for individuals with SCI/D to control objects in their environment was through the use of environmental control units (ECU), also referred to as Electronic Aids to Daily Living (EADL). Traditional environmental control units may still be appropriate for individuals who need switch access, are unable to speak, or require specialized solutions to operate medical devices such as hospital beds.

Today, “smart home” technology designed for home automation is widely available, offering accessible solutions for individuals with SCI/D. Smart home technology can be voice controlled or accessed via an app or remote controller. Smart speakers are commercially available devices equipped with far-field microphones for voice recognition that allow for hand-free operation of environmental control features from medication reminders to wirelessly connected appliances (such as Amazon Echo or Google Home). Switch options are becoming available (such as flic.io).

Some examples of opportunities for home automation and smart appliances are:

- Door locks
- Automatic door opener
- Lights
- Television
- Computer
- Stereo or Radio
- Intercom
- Thermostat



- Surveillance camera and security system
- Fans
- Coffee maker
- Oven / Crockpot / Microwave
- Dishwasher
- Washer / Dryer

Prior to choosing environmental control technology, the person's functional ability should be assessed to determine the most effective way for the person to interface with the environmental control system. The following sections discuss various access methods for environmental control.

COMPUTER ACCESS

There are many options that will help someone with impaired upper extremity function to access their computer and other personal electronic devices more independently. When considering these options, ease of use, fatigue, and the prevention of repetitive strain injuries should be considered. In most cases, users will find a mix of products to be the best solution to meet their personal, educational, or business needs. Touchscreens are available on some computers, offering additional accessibility. Please note tablets offer their own accessibility features and may combine solutions listed under computer and smartphone access options.

Voice Recognition: Voice recognition allows the user to access the features of the computer using their voice using specific commands. Basic voice recognition features are available on most computer platforms (windows, Mac) and advanced, customizable software is commercially available. The ability to dictate allows users to generate text at a faster speed than other methods. There is a learning curve to use dictation software efficiently to operate all of a computer's functions. In addition, a high quality microphone is imperative for achieving optimal functionality. For individuals with poor breath support due to tetraplegia, voice dictation may be best paired with other methods for maximal function. (Examples of voice recognition software for computers: Dragon Speech Recognition Software: <https://www.nuance.com/dragon.html> ; Braina Pro: <https://www.brainasoft.com/braina/download.html>).

Eye Control: Eye gaze technologies allow the user to access their computer by using the movements of

their eyes. Eye gaze can be difficult to master initially but allows for total computer control via the mouse and onscreen keyboard with for individuals who have minimal motor movements. (Examples: Tobii Dynavox Eye Tracking System <https://www.tobii.com/group/about/this-is-eye-tracking/>; Eye Gaze Edge: <https://eyegaze.com/products/eyegaze-edge/>)

Ergonomic Mouse Options: There are many types of accessible mice on the market. An accessible mouse can be paired with an onscreen keyboard to allow text generation for increased functionality. Commercially available ergonomic mice including variations in the size and shape of the mouse that may meet some users needs.

Trackball or Roller Ball Mouse: The rollerball/ trackball allows the user to move the by accessing a roller ball in one space without having a large reach in the arm. This can improve efficiency and reduce fatigue.

Pneumatic or Sip and Puff Mouse: A pneumatic mouse allows someone to access the mouse without the use of their upper extremity using the mouthpiece for sip and puff functions and/or as a joystick. (Example: Quadlife <https://quad.life/>).

Wheelchair Integration: Power wheelchairs with advanced electronics offer users the ability to access bluetooth mouse functions through their power wheelchair access device (Head array, sip and puff, joystick) and associated switches.

Electronic Pointing Devices allow control of the mouse through a special sensor affixed to the user's head or glasses. (Example: Tracker Pro 2 <https://www.ablenetinc.com/technology/computer-tablet-access/trackerpro-2> GlassOuse www.glassouse.com)

On-screen Keyboard displays a visual keyboard with all standard keys on the screen, allowing a user to select keys using a mouse or other pointing device.

Apps are available that allow smart phone control of the computer, using the touch screen as a track-pad mouse.

TELEPHONE ACCESS

There are numerous options to access both landline and cellular telephones. State-based accessible telecommunications programs may offer support to select and procure an accessible telephone.

Landline Telephone Options: There are voice controlled options for landline telephones. Lower cost auto-answer speaker phones allow individuals with SCI/D to receive calls automatically, but still require touch access for dialing. Switch based telephones are also available. Consider the weight of the receiver and size of the buttons when looking at landline access. For individuals who work in office environments, headsets may allow easier access for answering a large volume of calls.

Smartphone Options: Smartphone technology continues to provide more and more voice control and accessibility options. Each operating platform and model has its own accessibility options including a virtual assistant who can help make calls, send text messages, and perform internet searches using voice commands. Assistive touch functions minimize dexterity needed to perform smart phone functions and aftermarket blue tooth switches can provide switch access to smart phones. Consider how the user will activate the phone when it is asleep, make calls, send texts, and access apps and internet functions. Switch options are available for smartphone access such as Tecla-e <https://gettecla.com/pages/tecla-e>. Touch free options that respond to head movements are also available (such as <https://www.sesame-enable.com>). Mouse-style control of a smart phone is also possible with an adapted mouse system (such as GlassOuse www.glassouse.com)

Touchscreen Access For those with limited dexterity, devices are available to facilitate touchscreen access. A mouthstick allows someone with SCI to access a stylus through a mouth controlled stick. This can offer improved functionality on tablets for activities such as playing games. **Stylus rings** can be worn on the finger and give easy access to a more isolated pointer. **Typing splints and universal pointers** facilitate typing and pointing for individuals with poor dexterity but good upper body strength. For any of these options that will be used with a touch screen, check to be sure the input from the stylus will be sufficient for the type of touch screen access desired. For devices with capacitive touch, contact with a finger or

conductive material is needed and some styluses may be incompatible with certain touch screens.

Mounting Options: When considering accessibility of a smartphone, tablet, or laptop-- consider how it will be mounted to the wheelchair or the bed for access. There are many types of mounts available for individuals with disabilities as well as the general market. Modular hose or flexible mounts allow the user to move the device easily in and out of view while maintaining durability. (Examples: <http://modularhose.com/Assistive-Technology/mh-Tablet-and-Device-Solutions>)

Charging: Think about how the battery life and how phone will be charged; charge cords can pose difficulty for individuals with limited dexterity and numerous wireless charging options are now available on the market.

ADAPTED GAMING

Video game adaptations provide an accessible leisure opportunity. Products such as the Xbox adapted controller and the quadstick open the door to functional game play (<https://www.xbox.com/en-US/accessories/controllers/xbox-adaptive-controller> and <https://www.quadstick.com/shop/quadstick-fps-game-controller>).

SWITCHES

A variety of switches are available that can be used to access power wheelchair functions, environmental controls, or phone options. Depending on the requirements of the system, switches may be wired or wireless. An assistive technology practitioner can assist the client to determine their most reliable and functional switch access methods considering their switch activation abilities and available switch options. There are a variety of switch access methods. Some switches require direct contact (buddy button, microlight, wobble switch), some offer multidirectional control (mini joystick), some may be mouth operations (pneumatic switches), while some are highly sensitive and may be activated from nearby movement (fiber optic or proximity switches).

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