Chapter 8: Assistive and adaptive technology

Introduction

Assistive and adaptive technology refers to products, devices or equipment that are used to maintain, increase or improve the capabilities of individuals with disabilities (1).

Assistive and adaptive technology is based on the idea that different types of technology can be used to help people overcome practical difficulties, such as problems with communication or self-regulation.

A wide range of different interventions exist, using a wide range of different devices and equipment, which may be divided into high tech (uses electronic equipment) and low tech (does not use electronic equipment).

Here we focus on some interventions which use high-technology systems, such as apps, biofeedback and transcranial stimulation. For details of interventions based on low tech systems, please see Chapter 16 on Technology-based behavioural interventions on page 161.

Evidence

Determining the benefits of most forms of assistive and adaptive technology for people with autism is not currently possible. We must wait for further research of sufficiently high quality to be completed.

This may be because some technologies, such as apps, are too new to have a solid evidence base. However this situation may change in the next few years as there are several research projects underway at present (2, 3, 4).
NICE guidelines

The National Institute for Health and Care Excellence did not make any recommendations on most forms of assistive and adaptive technology but it did recommend (5):

‘Do not use neurofeedback to manage speech and language problems in children and young people with autism.’

Supply, quality and regulation

You can obtain some forms of assistive and adaptive technology, such as mobile devices, apps or computers, by purchasing them direct from the suppliers. However we would recommend that you consult your care team first, especially the speech and language therapist, if you are thinking of using an alternative and augmentative communication device. In other cases, you are always likely to need help from a professional. For example, transcranial magnetic stimulation is normally delivered by a trained professional in a medical or research facility.

Some regulating authorities oversee some specific forms of assistive and adaptive technology in some countries. For example, the US Food and Drug Administration has issued guidance on the use of transcranial magnetic stimulation devices. However, no regulatory system exists for most forms of technology, such as apps or neurofeedback training, in most countries (6).

Costs and time

Costs: the cost of different forms of assistive and adaptive technology will depend to a large extent on the specific form of assistive and adaptive technology being used. Costs may include the purchase of equipment and the cost of attending training courses and purchasing training materials. The cost will also vary depending on who is working with the recipient of the intervention. For example, if the person is a paid employee, the cost can be high. If a parent or carer is working with the child, the cost can be quite low.

Time: the amount of time required to use different forms of assistive and adaptive technology will depend to a large extent on
the specific form of technology being used as well as on the needs of the individual. For example, transcranial magnetic stimulation is normally delivered in several sessions at a medical or academic facility. Additional time may be required for travel to the facility.

Risks and safety

Different forms of assistive and adaptive technology pose different risks. For example, no risks are known for biofeedback but transcranial magnetic stimulation can sometimes produce seizures, painful scalp sensations, facial twitching and hearing problems (7).

Specific forms of assistive and adaptive technology

Apps

Introduction

An app is a computer application. Most people use the term app to refer to a computer programme (software) that can be downloaded and used on an electronic device, such as a mobile phone or a tablet.

An enormous range of apps is available and they all do different things (for example there are apps that forecast the weather, apps for well-known news providers, and games).

Aims

There are a number of apps which have been specifically designed to help people on the autism spectrum and each one will be designed to achieve different aims.
For example, the ReacTickles apps use touch, gesture and audio input to encourage interactive communication. Other apps provide help with life skills and literacy, provide social stories and visual schedules, or are games specifically designed for people with autism.

Some apps can be used by people with autism of any age and any ability while other apps may be more appropriate for people who can deal with complex systems and processes (8, 9).

Evidence

A large number of apps are aimed at people with autism, and new apps appear on a regular basis. So it is extremely difficult to study every app. Some apps are based on established interventions, such as the Picture Exchange Communication System (PECS), but the apps themselves have not been tested for effectiveness. Determining the benefits of any specific app for people on the autism spectrum is not currently possible. We must wait for further research of sufficiently high quality to be completed (2).

Risks and safety

No risks are known for most apps.

Additional information

The growing use of apps for people with autism is partly because of evidence that people with autism enjoy using computers and electronic devices such as mobile phones and tablets, so they may be more motivated to access an intervention provided on one of these. Furthermore, as tablets, mobile phones and computers are so widely used, a person with autism using an intervention on one of these devices will not stand out and this can help them blend in and be more accepted by society (10).
Auditory integration training

Auditory integration training is designed to improve a person’s ability to process sounds by ‘re-educating’ the brain. This is done by playing electronically modified music in which the frequencies have been changed.

For more information, please see Chapter 21 on motor-sensory interventions on page 229.

Biofeedback

Introduction

Biofeedback includes a range of therapies in which you are taught to control your own physiological functions such as brain waves, heart rate or muscle tension. During a biofeedback session, electrodes are attached to your skin. These electrodes/sensors send signals to a monitor, which displays a sound, flash of light, or image that represents heart and breathing rate etc. A biofeedback therapist helps you practice relaxation exercises, which you fine-tune to control different body functions. Over time you learn to use that feedback to change those functions. So, for example, you may learn to slow down your heart rate by seeing it displayed on a monitor.

- **EEG biofeedback (Neurofeedback):** Monitors and controls brain waves. Used to improve attention, impulsivity, hyperactivity, and IQ.

Biofeedback

**Definition:** a range of therapies which teach a person to regulate their own physiological functions, such as brain waves, muscle tension, or heart rate.

**Aims:** varies.

**Who:** people with autism of any age and ability who can understand the training.

**Evidence:** insufficient evidence to determine if biofeedback has any benefits.

**Risks:** none.
- **EMG biofeedback (Electromyogram):** Monitors and controls muscle activity and tension. Used for back pain, headaches, anxiety disorders, muscle retraining after injury, and incontinence.

- **HRA biofeedback (Heart rate variability):** Monitors and controls heart rate. Used for anxiety, asthma, chronic obstructive pulmonary disease and irregular heartbeat (11).

**Aims**

Biofeedback is designed to be used on people of any age and any ability, as long as they are able to understand the aim of the training.

Some people think that EEG biofeedback can be used to help people on the autism spectrum to control their brainwaves, which will help them to deal with a wide range of issues including the core symptoms of autism, attention, executive function, language and visual perception (12, 13).

Some people think that HRA biofeedback can be used to help people on the autism spectrum to control their breathing and heart rate and regulate physiological arousal, and in turn reduce reported symptoms of anxiety, depression, attention, and behavioural difficulties (14).

**Evidence**

Determining the benefits of biofeedback for people with autism is not currently possible. We must wait for further research of sufficiently high quality to be completed (3).

**Risks and safety**

No risks are known for biofeedback.

**Hyperbaric therapy**

Hyperbaric therapy is the medical use of oxygen at higher-than-atmospheric pressure. The oxygen is administered to the
individual in a pressurised chamber, with the goal of increasing oxygen absorption in bodily tissue.

For more information, please see Chapter 20 on Alternative medical procedures on page 219.

Mobile (portable) devices

Mobile or portable devices include any electronic devices that can be easily carried by one person. Mobile devices include cell phones (such as iPhones), MP3 players (such as iPlayers), laptops, personal digital assistants (such as Palms), prompting devices (such as pagers), tablets (such as iPads), etc. as well as some voice output communication aids (also known as speech generating devices).

Please see the entry on Apps in this chapter for more information about mobile devices such as phones and MP3 players. Please see the entry on ‘Voice output communication aids’ in Chapter 7 on Alternative and augmentative communication on page 90 for more information about them.

Transcranial stimulation

Introduction

Transcranial stimulation describes a number of different treatments which use painless electro-magnetic fields to stimulate nerve cells in the brain.

- Transcranial direct stimulation (tDCS): A constant, low intensity current is passed through two electrodes placed over the head. Anodal stimulation is designed to excite brain cell activity while cathodal

Transcranial stimulation

**Definition:** procedures that use electro-magnetic fields to stimulate nerve cells in the brain.

**Aims:** to target the core features of autism.

**Who:** adults with autism.

**Evidence:** insufficient evidence to determine if rTMS or tCDS have any benefits.

**Risks:** some risks are associated with both rTDCS and rTMS.
stimulation is designed to inhibit or reduce brain cell activity. tDCS is commonly used to treat a range of conditions such as depression, anxiety, Parkinson’s disease, and chronic pain (15).

- Transcranial magnetic stimulation (TMS): An electromagnetic coil is held against the forehead near an area of the brain that is thought to be involved in mood regulation. Then, short electromagnetic pulses are administered through the coil. rTMS is a specific form of TMS in which the pulses are repeated. TMS is used to treat a range of conditions including depression, Alzheimer’s disease and epilepsy (16).

Aims

tDCS and rTMS are designed to be used on adults of any ability provided they do not fall into one of several groups for whom it may be contraindicated eg. people with epilepsy. Due to the lack of data on the side effects of TMS in children, it has been suggested that TMS should only be used if there is a clear clinical reason, such as refractory epilepsy. Therefore, TMS should not be used in children with autism (16).

Some people think that tDCS can be used to help people on the autism spectrum in a number of areas including social interaction, hyperactivity and irritability (15).

Some people think that rTMS can be used to decrease repetitive behaviours and irritability and to improve attention in some people on the autism spectrum (16).

Evidence

Determining the benefits of any form of transcranial stimulation for people with autism is not currently possible. We must wait for further research of sufficiently high quality to be completed (4).

Risks and safety

The most common side effects of tDCS are mild tingling sensations, light itching sensation, moderate fatigue and headache (17). Some risks are associated with rTMS. Seizures,
painful scalp sensations, facial twiching and hearing problems due to the loud clicking noise emitted by the TMS machine have all been reported (7).

Additional information

rTMS requires patients to be completely immobilised in a prefixed position for tens of minutes at a time.

Video modelling

Video modelling is a method of teaching in which an individual learns a behaviour or a skill by watching a video recording of someone – the model – demonstrating that behaviour or skill. The model can be someone else – such as a parent or sibling – or it can be the individual him/herself – when the process is called video self-modelling (VSM). For more information, please see Chapter 16 on Technology-based behavioural interventions on page 161.

Further information

**In this book:** Please see How to use this book (page 11), Chapter 3 (page 38) for information about interventions, Chapter 4 (page 43) for information about how scientists evaluate those interventions, and Section 3 (page 284) for advice on making the decision about whether or not to use a specific intervention.

**Websites:** Please see www.researchautism.net/assistive-and-adaptive-technology for information about assistive and adaptive technology including information about specific forms of technology and details of scientific studies and trials.
References


