
UNIT 27 ASSISTIVE DEVICES FOR MOBILITY & SENSORY AIDS

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27.1 INTRODUCTION

In the various Units of this Package, we have described different types of aids and assistive devices which can help the persons with cerebral palsy to adopt correct postures during sitting and standing; those which can help them to communicate; those which can enable them to carry out activities of daily living like eating, toileting and bathing; and those which can assist them in the process of education.

Many persons with cerebral palsy who cannot move around on their own/ independently can be helped to be mobile by providing suitable aids and by eliminating the barriers in the structural environment. Assistive devices have a major role in enhancing the participation of persons with cerebral palsy in the home and the community, enable them to make use of the opportunities for education, work and leisure in the community and assist them to participate, or to be independent, in the activities of daily living.

Some persons with cerebral palsy may also have visual and hearing impairments. They can benefit from the use of sensory aids.

In this Unit, we shall focus on the assistive devices that can help the person to be mobile as well as the sensory aids which can help in vision and hearing.

Objectives

How will this Unit will help you?

This Unit will help you to understand and become familiar with:

- 1 the meaning, function and types of assistive devices;
- 1 the various types of orthoses that are useful for persons with cerebral palsy and guidelines for their use;
- 1 the different types of mobility devices which can be used by persons with varying levels of disability;
- 1 low vision aids for persons with visual impairment;
- 1 assistive devices for persons with hearing loss; and
- 1 aspects to be kept in mind when purchasing assistive devices

27.2 WHAT ARE ASSISTIVE DEVICES?

1 *Akhilesh, is a seven-year-old boy with cerebral palsy. This has affected his ability to move around on his own. His parents have to carry him whenever they go out from the house. At home, he can go from one room to the other by holding on to the furniture. Akhilesh is growing taller and heavier day by day. It is becoming difficult for his parents to carry him. Is there some way in which the situation can be made easier for Akhilesh and his family?*

1 *Cerebral palsy has affected Namita's hand function – she has tremors in her hand, which has affected her ability to hold objects. She wants to write like other children do, but the pencil/pen slips from her hand. This is frustrating for her. Can Namita be helped in some way so that she can write?*

Both these children can use assistive devices to overcome their difficulties. Let us first understand what are assistive devices.

Assistive devices are aids and adaptations that help persons with disabilities to participate in the activities of daily living, pursue education, move around in the environment, work and engage in leisure activities. Thus, by assistive devices we mean **‘any equipment that allows the person to function more independently by increasing, maintaining or improving his functional capabilities’**. These devices can either be used by the persons with disabilities themselves or they can use these with the support and help of others. Some examples of assistive devices are: communication boards, computers, calipers and crutches, writing aids and adapted utensils.

How are assistive devices helpful?

Assistive devices reduce barriers between the person with disability and his environment, enabling him to have better control over the environment. Let us see how this happens.

- 1 Assistive devices enable the person to have freedom of movement and, therefore, greater choice as well as access to the facilities of work, education or leisure. We know that these facilities are required for the all-round development of the person and enable him to participate in community life.
- 1 Assistive devices make it easier for the person to undertake activities that would otherwise be difficult. For example, a cup with two handles is easier to hold for a child whose eye-hand coordination is poor. Similarly, spillage of food due to limited eye-hand coordination or involuntary movements can be reduced by using spoon with bent or curved handles. To take another example, the use of the communication boards can help a non-verbal person to communicate effectively. In this case, the assistive device (communication board) has enabled the person to participate in various activities with others, which would otherwise be extremely difficult.
- 1 Assistive devices empower people with disabilities to live with dignity as equal, constructive and participating members of the society. It gives them freedom, choice and independence, resulting in the enhancement of their quality of life.

Functions of Assistive Devices

- 1 To provide support
- 1 To provide stability
- 1 For correct alignment
- 1 To provide safety
- 1 To enable use of present degree of function and enable desired movement to happen
- 1 To open up new field function
- 1 To substitute for a lost body part

27.2.1 Types of Assistive Devices

There are many types of assistive devices, all of which have a role in improving the lives of persons with disabilities. They can range from simple and inexpensive devices to computer-based expensive devices; from home-made to factory-made appliances. **For the purpose of our understanding, we have grouped these devices on the basis of the function they perform. Thus, they are mainly divided into the following categories:**

- 1 Prostheses and Orthoses
- 1 Mobility devices
- 1 Sensory aids (aids for vision and hearing)
- 1 Seating/positioning aids (also called postural aids)
- 1 Aids for communication
- 1 Aids for activities of daily living (eating/toileting/bathing/dressing)
 - 1 Education/learning-related aids
 - 1 Structural modifications
 - 1 Vehicle modifications
 - 1 Aids for Recreation

You have read about the **aids for seating and positioning** such as wedges, side-lying frames, adapted chairs, belts, T-positioning roll, standing frames **in Units 8, 9 and 10**. You have also read about the various positions and postures that should be adopted while sleeping, sitting and standing in these Units.

Communication aids such as communication boards, computers and VOCA have been discussed in detail **in Unit 12**. These aids enable a person with limited speech or no speech to communicate with others.

Aids for carrying out activities of daily living such as eating, toileting, bathing, brushing and dressing have been discussed **in Units 15-17**. In these Units, we have also described how to, make simple adaptations in the utensils we normally use for eating; how to make adaptations in the environment, such as in the bathroom, so that the person can carry out the task of toileting and bathing in a comfortable manner; how to make adaptations in clothing to enhance ease of wear; and the correct posture to be adopted during these activities.

Unit 20 describes a variety of **aids that can be used** to help the child **in the teaching-learning process**. These are aids such as the adapted pencil/pen, weighted bracelet, adapted chairs and tables, reading stand and head pointers. The use of adaptations in the material used for teaching-learning can greatly help the children who have physical and communication limitations to pursue education.

Aids for recreation have been discussed in **Unit 26** and further suggestions regarding how to make adaptations in the playground and play equipments, such as swings and merry-go-rounds, have been discussed in **Unit 28**.

Modifications in the built environment (structural modifications) can greatly enhance physical accessibility in the community for the person with disability. **Unit 28** gives detailed suggestions regarding how we can make the built environment in the home and the community barrier-free for persons with disabilities. This includes making modifications and adaptations in vehicles as well.

In this Unit, we shall focus on the first three categories of assistive devices we have listed above, i.e., prostheses and orthoses; mobility devices and sensory aids (aids for vision and hearing).

27.3 PROSTHESES AND ORTHOSES

‘Prosthesis’ is a Greek word which means ‘in addition’. Prostheses are devices designed to replace, partially or completely, a part of the body. For example, artificial teeth and artificial limbs like legs and arms. These are recommended in case of amputation (i.e. loss of that part of the body) due to medical reasons, accidents, trauma or congenital problems (problems present at the time of birth). However, **most children with cerebral palsy do not need prostheses** because their body part is present; but it is the coordination of the body parts which is affected. **What most children with cerebral palsy need are orthoses.**

Orthoses are devices worn over a body part. For example, a brace, a splint or a caliper. The word ‘orthosis’ is derived from the Greek word ‘ortho’ which means ‘to make straight’. These devices align and straighten the body part, prevent or correct deformities and support movement of that part of the body.

An orthosis can be used either as a **brace** or a **splint**. A splint prevents a body part from moving. For example, plaster—which is applied to a fractured bone—is a kind of a splint, as it restricts the movement of that body part. A brace allows some movement while providing support and/or holding a body part in its correct place.

27.3.1 Functions of Orthoses

Based on the functions they serve, orthoses have been divided into the following categories.

1. Supportive Orthoses

These types of orthoses allow the individual to control or stabilize abnormal/atypical movements. You have read in Units 1 and 2 that some children with cerebral palsy have involuntary movements of various body parts. Supportive orthoses control these movements and, therefore, support that part to perform an action. **For example, ankle foot orthosis,** is used by children who have abnormal movements around

their calf, ankle and foot, which prevents them from standing with the heel down. The ankle-foot orthosis helps in proper weight bearing while standing (i.e., the person is able to stand with the heel on the ground).

2. Functional Orthoses

The orthoses which provide for the lost function of the affected joint comes under the category of functional orthoses. For example, wrist orthosis keeps the wrist in the extended position, i.e. prevents the wrist from bending. Thus, persons whose wrist is always bent can use their hand more effectively to grasp a pencil/spoon using functional orthosis. **An example of functional orthosis to be worn at the wrist is cock-up splint.**

3. Corrective Orthoses

You already know that individuals with cerebral palsy develop contractures due to incorrect postures (recall Unit 2). These contractures can cause deformity of that part. Hence, contractures need to be corrected. Thus, **corrective orthoses are those which are used to correct or realign the body part.** For example, due to wrong body postures, the spine of some children curves to the side in the shape of an 's' or curves forward like a 'c'. In this case, **spinal braces/jackets** can be worn on the upper body to maintain an erect posture. If worn regularly, this can prevent further deformity.

4. Protective Orthoses

These orthoses protect the body part from damage. For example, a helmet padded with foam can be worn on the head to protect the child from injury when he may fall due to poor balance.

It is important to state here that a single orthosis can perform all the functions stated above or a particular orthosis can be used to perform a specific function. For example, ankle foot orthosis (AFO) not only supports the leg, but also corrects the posture, protects the body part and has functional utility, as it helps in standing. Thus, the AFO performs all the four roles of an orthosis.

Orthoses are generally made by making a cast of the individual's limbs or by taking a measurement of that area. In other words, they are **person-specific and tailor-made** (or custom-made) to suit his measurements and needs. This is very important as they are meant to meet the specific needs of an individual and, if they are not of the exact size of an individual's body part, they will fail to serve the purpose.

27.3.2 Types of Orthoses

Described below are some upper limb and lower limb orthoses, which are used by people with cerebral palsy. The names of the orthoses are based on the joints that they encompass.

A) Lower Limb Orthoses

Lower limb orthoses are devices used to restore or improve functional abilities of the legs. They have been classified on the basis of the joints or the body part they are worn on. Their classification is as follows:

1. **Foot orthosis:** It is a device that is moulded to the foot and is **used to reduce the incorrect position of the foot**. For example, in case of children who have a flat foot, an orthosis called '**medial arch**' can be inserted in the shoe, which helps to correct the flat foot.
2. **Ankle foot orthosis (AFO):** Ankle foot orthosis is **designed to support, protect, prevent, or correct deformity, and improve functioning of the foot and the ankle**. There are various types of AFO's available in the market. Figs. 1(a) & (b) show two different kinds of AFOs that are available to meet the specific needs of the person.



(a)



(b)

Figs. 1(a) & (b) : Ankle foot orthosis (also called AFO's)

3. **Knee ankle foot orthosis (KAFO):** Knee orthosis are **designed to correct deformities of the knee, along with those of the ankle and the foot**. Like ankle foot orthosis, there are various kinds of knee orthosis - some of them support the injured or the weak knee while others correct contractures and prevent deformity of the knee joint.

An example is the **3-bar or 3-point gaiters** to correct knee deformity, shown in Figs. 2(a) & (b). These can also be used in combination with AFO, if there is a deformity in the foot/ankle as well. This orthosis is light-weight, easy to make and can be made at home also. Fig. 2(c) shows a child wearing the gaiters and standing with the help of a standing frame.



Fig. 2(a): 3-bar gaiters



Fig. 2(b) : 3-point gaiters



Fig. 2(c) : A child standing with the support of a standing frame and gaiters.

B) Upper Limb Orthoses

Upper limb orthoses are devices used to restore or improve functional abilities of the arm. They can be made according to the needs of the individual. They have also been classified on the basis of the joints or the body part they are worn on. The classification is as follows:

1. **Upper arm orthosis: These are used by individuals who have severe elbow contracture.** Such persons benefit from elbow orthosis. An example of this is the **arm bands**, which are tied around the elbow. This helps to prevent or correct contractures by maintaining or increasing elbow extension. Fig. 3 shows an arm band.



Fig. 3 : An arm band : Upper arm orthosis

2. **Hand Orthosis: They are used to maintain and support the hand/wrist and, at the same time, position the fingers** while performing fine motor activities like grasping, writing and so on. They can also be used for correcting contractures of the wrist joint.

Functions of Orthoses

Thus, based on the above description, we see that orthoses have various functions:

- 1 To support and maintain a weak limb
- 1 To increase the range of motion against gravity
- 1 To correct or prevent contractures and deformities
- 1 To improve function
- 1 To serve as an attachment for other devices. For instance, writing aids and spoons can be attached to hand orthosis.
- 1 To relieve weight-bearing and pain
- 1 To block and control unwanted movement of a joint

27.3.3 Guidelines for the Use of Orthoses

- 1 A close-fitting orthosis can sometimes cause redness of the skin. Loosen or remove the orthosis until the redness disappears. Consult the therapist if there is frequent redness. It is also possible that the child may need an orthosis of a larger size or may be allergic to the material of the orthosis. To avoid rash and inflammation, one can wear socks or stockings to reduce friction of the orthosis with the skin and protect the skin from perspiration. One can also use talcum powder and change socks promptly to be more comfortable.
- 1 Any part of the body covered by orthosis must be washed daily with mild soap and water.
- 1 The body part must be completely dry before wearing the orthosis.
 - 1 Ask the therapist about the duration for which the orthosis is to be worn in a day. Sometimes, when the person remains in a standing position for an extended period during hot and humid weather, it can result in swelling and inflammation. Remove the orthosis and elevate the person's leg, until the swelling subsides. Consult the therapist in case the problem persists.
- 1 Orthosis needs to be wiped clean with warm soapy water, or mild disinfectant like spirit, and then left to dry. Do not soak the orthosis in water or attempt to hasten drying by placing the appliance in front of a heater. Orthosis can be towel-dried or left to dry at room temperature. Moving metallic parts must be oiled once a week.
- 1 One must also be careful about the size of the orthosis while buying them. The heel of the shoe should be of the same height as the heel of the person for whom the orthosis has been designed. Excessive height or less than required height can cause back and knee strain.
- 1 Orthoses are tailor-made for each person. The measurements of growing children need to be checked at regular intervals to maintain proper fit. Replace worn out portions immediately.
 - 1 Do not make a person walk while he is only wearing the AFO, as he may fall because of the slippery plastic. A plastic ankle/foot orthosis has to be worn with a shoe. While buying shoes, make sure that the person tries them on while wearing the AFO, or else you may end up buying a smaller shoe.
 - 1 Learn the correct way of wearing the orthosis from the physical and occupational therapist.

An orthotic aid must be

- 1 Light
- 1 Should be easy to wear and remove
- 1 Must not irritate the skin or cause pain
- 1 Should be of durable material and long-lasting
- 1 Should exert firm and steady pressure on the joint
- 1 Should be reviewed at regular intervals for its size and fitting.

27.4 MOBILITY DEVICES

Mobility aids are a type of assistive devices, which help the persons with physical difficulties to move around in the environment. Mobility devices, thus, increase the person's opportunities to explore, participate and contribute to the activities going on in the environment.

To decide upon what kind of mobility device is appropriate for a person, one needs to think not only about the type and degree of disability, but also the circumstances and the environment in which he is going to use the aid. For example, if the terrain is largely uneven and the person is required to cover a large distance, then an adapted tricycle will be more useful than a rolator. The latter will be more useful within his home for covering shorter distances.

Mobility devices include

- a) Sticks/canes
- b) Crutches
- c) Tetrapods/Tripods
- d) Rolators/walkers
- e) Buggies/Prams
- f) Wheelchairs
- g) Tricycles
- h) Creepers and crawlers
- i) Trolleys
- j) Vehicles

27.4.1 Canes

Canes are walking sticks, which are mostly used by old people or by persons with mild locomotor disability. It is a long stick, which can be adjusted to various heights and has a handle to hold on to. Children with cerebral palsy can also use this type of stick for mobility. It is the simplest device to get one moving independently.

Canes are effective in providing stability and balance to individuals with minor leg or trunk difficulties (weaknesses), and those with injury and pain.

There are a variety of canes available in the market made of wood or aluminium tubings. There are foldable and unfoldable, as well as single-point and multiple-point canes. Most of them have a nylon grip at the end to prevent slippage.

The height of the cane is important. When held straight and touching the ground, the cane should reach up to the wrist joint. This is the correct position of the cane. When the hand grasps the cane, the person's elbow should be bent slightly at an angle of 15-20 degrees.

Replace cane tips when worn out. Worn tips can cause slipping/skidding and can also shorten the cane height. Worn cane tips are easily removed by placing the tip in a slightly closed door and then twisting to pull off the cane tip.

When using the cane in the house, remove loose rugs to prevent tripping.

27.4.2 Crutches

These are mostly used by persons who have mild level of disability in the lower limbs. Crutches are generally used when one needs more support than what is available with the cane. They are of two types:

1. Axillary crutches: These crutches rest under the armpits. These may or may not be adjustable in height and are generally used by those people who have good shoulder and arm control, but have weakness in lower extremities, for example due to polio. They are generally made of wood or aluminum.

While buying the crutches, remember that the top of the crutch should be three fingers' width below the armpit, so that it does not press under the arms. In this way, the child will be taking his weight on his hands and not the armpits. Train the child so that he does not lean down on the crutches. Excessive armpit pressure can lead to arm pain, numbness or weakness.

The hand grip to hold the crutch should be at such a height that the elbow is bent a little, so that arms can lift the body when walking. The

handgrip should be placed for comfort – usually about 1/3rd of the way down the crutch. The crutch tips should be replaced when worn, so as to prevent slippage when walking.

2. Elbow crutches: These are mostly used by people with cerebral palsy. These crutches rest at the forearm level and are worn at the elbow. They have a handle at the level of the hand to hold, so as to transfer the body weight of the individual to the crutch while walking. They are light in comparison to axillary crutches and are made of aluminum or steel. Fig. 4 shows a person with cerebral palsy walking with the use of elbow crutches.



Fig. 4 : A person walking with the help of elbow crutches

27.4.3 Tripods/Tetrapods

A person who is able to use the rolator/walker (described in sub-section 27.4.4) and now needs to move on to using a crutch, which gives less support, can be first helped to learn to walk using a tripod or a tetrapod. See Fig. 5. **A tripod or a tetrapod gives less support than a crutch but more support than a walker/rolator.** It helps the person to develop balance and then he can move on to using the cane or the crutch. **Tetrapods and tripods are generally restricted to indoor mobility.** They are not very functional for long distances and outdoor mobility.



Fig. 5 : A person walking using a tetrapod

27.4.4 Walkers/Rolators

If a person is able to stand but has moderate degree of difficulty with balance, strength and endurance, he may require the assistance of certain devices to be mobile. **Rolators and walkers provide assistance to such individuals with moderate degree of difficulty in walking.** Walkers are generally without wheels, whereas rolators always have wheels. Generally, they are made of wood, cane, or aluminum. Walkers and rolators offer stability and support while walking. There are many types of rolators and walkers available in the market - foldable and non-foldable. A walker without wheels is more difficult to move, yet it provides the maximum stability and safety as one takes steps. Rolators (with wheels ranging from one to four) are generally used by those who have good balance and want to move a longer distance without tiring themselves.

The rolator is made depending on the child's need (how much support the child requires), on this basis of his present gross and fine motor abilities and the child's height. For example, **if the child needs more support, has poor balance and is just learning to walk, he can use an anterior rolator**, i.e., with front wheels that he can push forward, as shown in Fig. 6(a). One needs to be careful that the rolator does not reinforce a wrong pattern of moving. For example, the child should not excessively bend the trunk forward or put excessive body weight on the rolator.



Fig. 6(a) : A child using an anterior rolator

If the upper body does not require support and the person has strong arms and good body control, then one can use a posterior rolator, which the person can pull with the arms, as shown in Fig. 6(b).



Fig. 6(b) : A person using a posterior rolator

Some children with poor balance and weak muscles may need a rolator which provides extra support at the sides, as shown in Figs. 7(a) & (b).



Fig. 7(a) : Rolators with additional side supports



Fig. 7(b) : A child using a rolator with additional side supports

Fig. 8 shows foldable rolators. These are easy to carry around when travelling.



Fig. 8 : Foldable rolators

The height of the rolator/walker from the ground is important. It should be at such a height that the elbow subtends an angle of 15-20 degrees while holding the rolator.

A child whose legs need to be kept apart while walking (in other words, who has the condition of **scissoring of the legs**) requires a walker or a rolator with a **horizontal bar** to prevent crossing over of the legs.

Cart walker or 'gadola' can be helpful for young children who need to learn to stand firmly and walk. One can keep some object in the cart. This added weight in the cart will help the child to stand firmly without falling over.

27.4.5 Prams/Buggies

For very young children, who are not able to move on their own, one can use a pram or a buggy to move them from one place to another, as shown in Figs. 9(a) & (b).



Fig. 9(a) : A buggy or a pram

Fig. 9(b) : A child enjoying the outdoors in a pram.

27.4.6 Wheelchairs

Most children who need a wheelchair either have severe weakness in lower limbs or are unable to move on their own. For such individuals, wheelchairs can help to move around. The wheelchair needs to be adapted not only to the individual child, but also to the particular family, the child's immediate environment and the community. Like canes and crutches, wheelchairs also come in different designs, are made up of different materials, have adjustable parts, can be foldable or non-foldable, and can be self-driven or propelled by another person. Fig. 10 on the next page shows a wheelchair that can be self-propelled.



Fig. 10 : A wheelchair that can be self-propelled

1. Aspects to be kept in mind while choosing a wheelchair

A wheelchair is an expensive mobility aid and, therefore, needs to be chosen carefully. This aid requires maintenance of some of its parts. Consider the following aspects before purchasing a wheel chair.

i) Needs of the child

A child with cerebral palsy may be adopting incorrect seating postures. Hence, one must choose wheelchairs which help to correct these incorrect positions and support good posture. The wheelchair should meet the specific needs of the child and should be made or adapted keeping in mind the disability, age and the size of the child. The therapist can help to select the wheelchair that is appropriate for the child. **The example below brings out the necessity of having a wheelchair that is appropriate to the needs of the child.**

Raju, a child of 8 years, has severely affected legs and hips. If he sits on a chair without a backrest, his legs stiffen backwards and the muscles tighten. The therapist says that if Raju is left in this position for long, he can have a permanent deformity.

Raju uses a wheelchair but it is inappropriate because of the following three reasons:

- 1 *The backrest of the wheelchair is made of cloth, which tends to sag after sometime. Thus, the backrest is present but it does not provide sufficient support, causing his legs to stiffen and straighten.*
- 1 *The height of this cloth backrest is less than required and, therefore, it supports the back only up to a point. Lack of proper support causes the back to curve, causing curvature of the spine.*
- 1 *The foot rest is too far for Raju. Thus, he cannot rest his feet on the footrest and so his legs remain stiffly straight.*

The therapist suggested the **following modifications** in his wheelchair;

- 1 The cloth backrest was replaced by a firm backrest, made of board, which would not sag. This facilitated Raju to maintain correct posture while sitting.
- 1 The height of the backrest of the chair was increased to provide full support to the back.
- 1 The foot rest was raised to the height where it could support Raju's feet and foot straps were inserted. This enabled him to keep his feet on the foot rest and his legs remained perpendicular to the floor, instead of stiffening backwards.

(ii) Physical Environment

The utility of wheelchairs has been found to be limited in rural areas. Rough terrain leads to quick wear and tear as well as breakages. The exposed metallic parts get corroded easily by moisture, dust, mud and other substances. Moreover, in these areas, ground level mobility aids are more suitable, as day-to-day activities like working in the fields and cooking, is mainly done at the ground level. Wheelchairs work well at places where the land is flat, fairly smooth and leveled.

(iii) Cost

Earlier many of the assistive and mobility devices were imported from developed countries. However, this had many disadvantages. Wheelchairs in developed countries often use high-technology materials like aluminium alloys, titanium and carbon fibre. These wheelchairs are usually unaffordable by most users in developing countries, like India. Non-availability of spare parts and lack of maintenance facilities in local areas are additional drawbacks. Also, the design of these wheelchairs is based on specifications intended for people in the developed countries. Often, these wheelchairs are oversized for the Indian population. The width and depth of seat and the height of the arms rest are unsuitable for Indians.

To cope with this situation, the ALIMCO (Artificial Limbs Manufacturing Corporation of India), a non-profit making organization, working under the aegis of the Government of India, was set up in 1972. It manufactures 350 types of aids and appliances for use by the orthopaedically, hearing and visually handicapped persons, including electronic and motorized wheelchairs. The quality of the aids and appliances conform to standards laid down by the Bureau of Indian Standards (ISI), and are available at a reasonable price. The products have been well-accepted in India as well as in other countries. The distribution of these aids and appliances takes place through 170 Limb Fitting Centres all over India. ALIMCO has also developed electronic hand and motorized wheelchairs for persons with disabilities.

One can further bring down the cost of purchase by availing the benefits of the **Scheme Of Assistance for Fitting of Aids and Appliances (ADIP**

Scheme) of the Ministry of Social Justice and Empowerment, Government of India. The Ministry of Social Justice and Empowerment recognizes Registered Societies, Charitable Trusts, Red Cross Societies, ALIMCO centers, District Rural Development Agencies, Local Bodies, such as Zila Parishad and, hence, the assistance can be availed through these agencies. One can get partial or complete assistance in buying all types of prosthetics and mobility aids through this scheme.

2. Characteristics of a wheelchair

One must consider various aspects of the wheelchair before buying it. Some of these are discussed below:

(i) Wheels

Large wheels with rims help the rider to push the chair on his own, and are also more suitable for rough terrain, as they can move easily over rough surfaces. Notice that the wheels of wheelchair in Fig. 10 have rims to enable the person to move them. Small wheels are more suitable if the child has to be propelled by another person. It can also pass through doors more easily and takes up lesser space.

One can also look for models which have removable wheels and, therefore, require less storage space when not in use and can be carried in a bus or a car.

(ii) Material of the wheelchair

The wheelchair should be made of strong and long-lasting material, which should be durable, yet light. The cost would vary with the kind of material used. Generally, wheelchairs are made up of aluminium, steel, wood, leather and cloth. Parts of the wheel chair, like wheels and ball bearings must be rust proof, easy to maintain, replaceable and locally available.

When the wheelchair is used for toileting, it needs to be washed and cleaned frequently. Hence, choose a material for the seat that can be washed frequently.

(iii) Seats and backs

The seats and back of the wheelchair should be firm. Look for the right kind of firm back and seat that will support the child's back and hips, as well as ensure good posture. The seat and back can be made of metal or wood. However, very hard support also tends to increase muscle tone and can lead to pressure sores. Hence, you need to provide the child with cushions to prevent sores. Or else, the seat can be padded with a medium density foam to support the curves of the child's body. The seat should support the entire thigh and should extend to just behind the knee. A seat that is too deep (too broad) causes the edge to dig in behind the child's knees, pushing the leg and the bottom of the pelvis forward. A seat that is too shallow (not broad enough) does not support the child's thighs and the weight of his legs, pulls his thighs downwards and the bottom of the pelvis forward. The seat should not sag and can

be a little oversized for a growing child. Yet, it should not become unsuitable for the child. Many children require back support till the head. For such children, attention should be given to the type of support provided to the head. The head can get pushed forward due to wrong support causing bending of the neck. It is best to consult with the therapist for the right kind of head support.



Fig. 11 : A wheel chair with back support till the head, side supports, straps, foot rest and padded support at knees.

(iv) Arm rest and foot rest

Many children may require arm rest for support and better positioning. The arm rest can also be used to keep a tray which can be used as a table by the child, as shown in Fig. 12.

However, children with adequate trunk and neck control may not prefer an arm rest at all. Many times, it is easier for the child to move a wheelchair without arm rest on his own. Also, in a chair without arm rests, the child can slide out of the chair from the side, especially when his arms are affected. Hence, the decision regarding whether or not have arm rests and the arm rest's height and length, will be determined according to the child's needs. Many chairs have an inbuilt arm rest and it is not possible to remove it.

A suitable foot rest ensures good positioning and supports the feet. This helps the whole body to stay in a better position while sitting. Also, if the feet are not resting on the foot rest, then the hanging feet can lead to tip-toe contracture.

A good foot rest should keep the knees and ankles at right angles and the legs slightly separated (more important in case of scissoring of legs). If the foot rest is too low, wedge-shaped blocks can be placed on it to make it higher. These can be removed as the child grows.



Fig. 12 : A wheelchair with arm rests allows the child to slide in a wooden tray which he uses as a table. He is painting with the help of a head pointer.

A foot rest which can be screwed or bolted onto the wheelchair can be beneficial when one needs to change its position, as the child grows. Similarly, a swinging foot rest is suitable while moving out of the chair. In case the wheelchair has no footrest, then the seat can be mounted low so that the feet can rest flat on floor.



Fig. 13 : A wheelchair with fixed arm rests, outreach front castors (wheels) & adjustable foot rests.

(v) **Special features**

If the child is able to use only one arm/hand, a wheelchair which can be propelled by one hand only could be used, as shown in Fig.14. Such a wheelchair has a lever attached to it, using which it can be propelled.



Fig. 14 : A chair with a lever fixed to the left wheel which allows the person to operate it using only the left hand.

Now-a-days, motorized or battery-operated wheelchairs are also available in the market. However, since the physical environment is not barrier-free, many people cannot use these assistive devices to move around.

3) Adaptations in a wheelchair

Most children who need a wheelchair, or a special seat, have severe weakness in parts of their bodies or muscles that pull them into awkward or deforming positions. Seating, therefore, must not only provide support but allow them enough freedom to move and explore. Here are a few adaptations that can help a child to be seated comfortably and appropriately in the wheelchair.

a) Need: A child who lacks proper muscle tone and does not have head control would be floppy and will not be able to sit.

Adaptation: A child without head and trunk control would require a seat with a collar or straps or harness to hold him to the back of the chair while sitting. Unit 8 provides illustrations of chairs with straps and belts to hold the child in position. Refer to this Unit for details. The number of straps would depend on the amount of support the child requires. Remember to un-strap the child at frequent intervals as he requires free movements and exercises to develop more independent head and trunk control.

As the child develops head control and then trunk control, the support of the straps can be removed gradually.

Similarly, a high back chair will be helpful for such a child, as it will support the back of the body till the shoulders. As the child learns to sit, one can decrease the support at the back.

b) Need: Chair too big for the child.

Many a times, the wheelchair may not be according to the size of the child. At times, parents may buy a bigger wheelchair, as they think that the child will quickly outgrow a smaller chair.

Adaptation: To make such a chair smaller in size, one can make the seat and the back narrow by placing cushions at the sides and back of the wheelchair.

c) Need: Child's back arches backward, causing the legs to straighten in the horizontal direction, which is an uncomfortable sitting posture.

Adaptation: One can strap the child's hips, knees and ankles (according to the need) to keep the child's legs in the correct position, perpendicular to the foot. Similarly, an adjustable foot rest with straps can also be made. The strap at the hips should be at an angle of 45 degrees. You may need to provide a knee block as well. In some cases, you may need to provide a ramped seat as well—in other words, a tilted seat—so that the child's entire body is tilted backwards while sitting, as shown in Fig. 15. See Unit 8 for details regarding these adaptations.



Fig. 15 : This is a chair with a built-in ramped cushion seat. In the same way, a ramped cushion can be placed on the wheelchair.

d) Need: Child has poor head control or head tilts to one side

Adaptation: One can have adjustable padded head support to keep the head in position.

e) Need : Child has scissoring of legs

Adaptation: In case the child has scissoring of legs, one can have a knee separator on the seat.

27.4.7 Tricycles

A person who can use his legs to pedal can use a tricycle as a mobility device. It helps to cover longer distances as compared to a wheelchair. It gives alternate form of mobility to the children who are able to crawl. Fig.16(a) shows a tricycle has been adapted for a child by putting straps for safety at the level of the abdomen and a wooden support with Velcro at the pedals, so that the foot does not slip out of the pedals while pedalling. These tricycles are available in the market.



Fig. 16(a) : A tricycle adapted for the child which is available in the market

While for the child the tricycle is a recreational activity as well as a means of exercise, for the adult it serves as a mobility device which enables his participation in work, leisure, education and household activities. Fig. 16(b) shows a child using an adapted tricycle to carry out everyday tasks.



Fig. 16(b) : An adapted tricycle helps people to participate in the community life

27.4.8 Creepers and Crawlers

Creepers and crawlers are mobility devices which the child operates by lying on it. On the creeper, the child lies on his stomach with the legs on the creeper itself. He propels himself forward using his arms. On the crawler, only the child's upper body rests on the crawler seat. His arms and legs are in crawling position on the floor. The child is strapped on to these mobility devices for safety. These aids have wheels. Fig. 17(a) shows a creeper and Fig.17(b) shows a crawler.

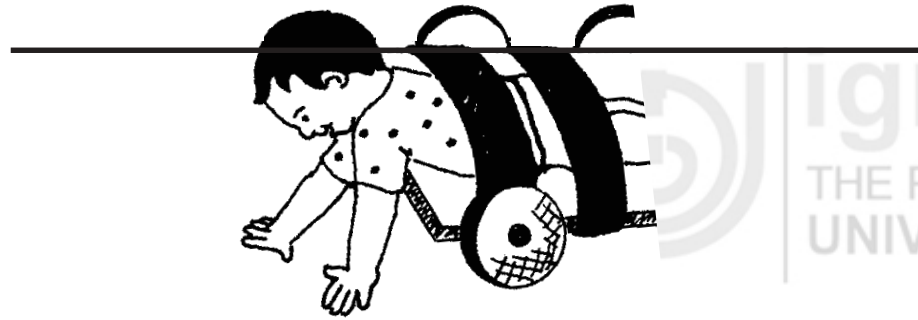


Fig. 17(a) : A creeper



Fig. 17(b) : A crawler

27.4.9 Trolleys

A trolley consists of a wooden platform fitted with four/three wheels. Trolleys can be either self-propelled by using handpads, or moved by another person. If the person can push the trolley on his own, it is fitted with rims on the wheels to enable the person to move them, as shown in Fig. 18(a). If the trolley has to be moved by another person, then it is fitted with a handle, as shown in Fig. 18(b). A trolley is more useful than a wheelchair in places where tasks are performed close to the ground level, which is usually the case in rural areas. For example, food preparation while sitting on the floor,

welding, craft work and masonry are some of the tasks generally done while sitting on the ground.



Fig. 18(a) : A trolley that can be self-propelled



Fig. 18(b) : A trolley that can be propelled by another person

27.5 LOW VISION AIDS

In this section, we shall describe the various types of low vision aids and explain some procedures in the use of these aids. **The low vision aids are broadly classified as optical aids, non-optical aids and electronic aids.** Before selecting the low vision devices/aids for the person with low vision, check that the person has been examined by an eye specialist to see if spectacles are needed to correct or improve vision.

27.5.1 Optical Aids

Optical aids refer to all those optical devices that magnify the size of the object, which may be near the person or at a distance, and thus help the person in recognition of objects. A common optical aid is a reading magnifier.

Reading Magnifiers: There are various types of magnifiers that can be used for the purpose of reading. Magnifiers are microscopic lenses which magnify the size of the print or object seen. The lens needs to be placed at the proper position with respect to the page or the object. A magnifier can be carried along by the person, so that it can be used at all times of need. Magnifiers come in different shapes, sizes and powers of magnification. They can be either held by the user or can be placed on a stand or paper itself.

Fig. 19(a) shows a stand magnifier which magnifies the entire sheet at one go. Fig. 19(b) shows a magnifier which magnifies one line at a time.



Fig. 19(a) : A stand magnifier magnifies the entire page at one time.

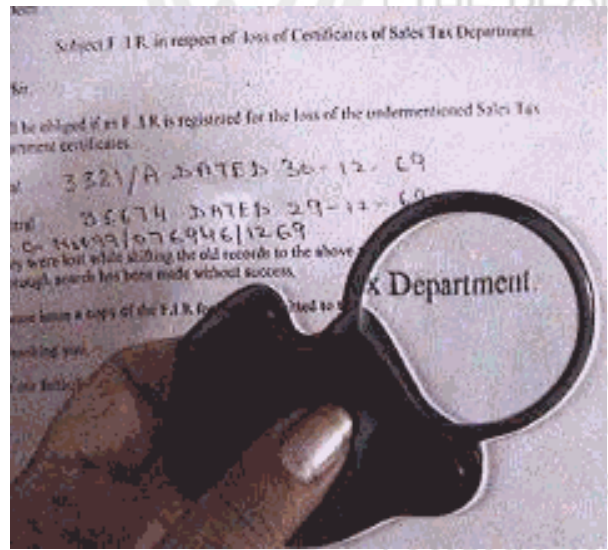


Fig. 19(b) : A hand-held magnifier magnifies one line at a time.

27.5.2 Non-optical Aids

Many persons can benefit from the use of non-optical aids which assist the person in functioning more efficiently in the environment. The general categories of non-optical aids are : absorptive lenses, illumination aids, reading and writing aids, talking appliances and enlarged/magnified objects.

A brief description of each of these follows:

(1) **Absorptive Lenses/Glare Control Devices:** These help to control too much lighting and glare. These are of two types:

- **Sunglasses:** Ordinary sunglasses serve this function.
- **Glare control filters:** They are useful for persons who have extreme photophobia or sensitivity to light. The filters or tints limit the amount of light entering the eye by absorbing the light themselves. The filters are available in various colours. Depending upon the need of the person, and after testing which filter the person responds to best, you can choose an appropriate filter. For example,
 - gray and green filters are used for ultraviolet sun protection
 - orange and yellow filters are used for increased contrast
 - side shields and top shields are used for reflected light

(2) **Illumination Aids:** Many low vision persons need more lighting or more controlled lighting to enable them to carry out visual tasks. 'Lighting' refers to both natural and artificial light, both inside buildings and outside.

When strong lighting is required, a table lamp with flexible neck can be used. Both incandescent bulb (ordinary bulb) and fluorescent lamps (tubelight) can be used, depending upon the need of the user.

However, the person can move to different positions to alter the amount of light. Thus, certain tasks may be performed best in direct sunlight, others in a brightly lit area and yet others in shade.

Problems with too much light

Vision can be worse for some persons in bright sunlight. They perform better in bright but shaded areas. If they need to be in the sun, they can wear anti-glare glasses.

Direction of light

It is better to have light coming from behind and to one side, rather than facing the light. Have light focused on the work being done.

(3) **Reading and Writing Aids:** The following are some of the aids that can be useful for persons with low vision for reading and writing.

- **Large print books** can prove to be most valuable for persons with low vision.
- **Felt tip pens**, also known as sketch pens, are helpful in everyday writing activities.
- For persons with low vision who find it difficult to see the lines on regular writing paper, bold line paper may be used.
- **Typoscope** is a black cardboard or plastic sheet with a window cut out. This will block out all other lines except the one that is being read. The black surface also reduces glare on the print page and improves contrast of the letters. Typoscope can be made out of cardboard and black paper. Varying sizes of typoscopes can be constructed for different books or paper. Fig. 20 is an illustration of a typoscope. You can make this at home yourself. As the person reads one line, the typoscope can be moved to the next line.



The two friends were going home.

Fig. 20 : A typoscope

- **Reading stand** can be used to help in proper positioning of the reading surface. The reading stand allows the person with low vision to bring the reading material close to the eyes in a vertical position. This position allows both hands to be free for other tasks such as writing. Figs. 21(a) & (b) show persons reading with the help of a reading stand.



Fig. 21(a)



Fig. 21(b) : Reading stands help the person to keep the material at a convenient height to read. The height of the reading stand is adjustable.

(4) Talking Appliances: These appliances have added auditory input or display. Some examples of talking appliances are watch, calculator, telephone, alarm clock, blood pressure instrument and microwave oven. All these appliances actually say or call out the reading.

(5) **Magnified Objects:** The object itself is bigger with bolder markings, so that low vision users can benefit. Some examples of magnified objects are telephones, watches, remote controls, calculators, thermometers, medicine boxes, address books, calendars, and playing cards of games. Figs. 22(a) and (b) show a magnified telephone and a watch.



Fig. 22(a) : A telephone with magnified numbers



Fig. 22(b) : A watch with magnified numbers

(6) **Recorded Material:** Children who have visual difficulty along with cerebral palsy can use recorded material for education. These materials may be pertaining to a specific subject and may have to be prepared occasionally. To prepare these materials, a person with good quality of voice reads out the text, which is recorded on cassettes. Recorded cassettes have the advantage that the visually impaired children can listen to them at their own convenience and replay them. Also, they are not dependent on others to be present at that time. This helps improve their learning.

27.5.3 Electronic Devices

1. Close Circuit Television: can also be used by children who have visual difficulty along with cerebral palsy. The system includes an inexpensive television camera which is focused on the reading material. The enlarged images of the letters then appear on an ordinary television set or monitor. The movement of the camera, the magnification, intensity and contrast of the image produced on the television set, are under the control of the person with visual impairment.

2. Computer Based Technology

(1) **Large Print Computer (LPC) :** This is useful for people with low vision. This facility is available on an ordinary computer and does not require any special programme. It enlarges the text displayed on the computer screen, which makes it easy for the person to read. It is also possible to take a print-out of the enlarged text.

(2) **Talking Screen Text Writer:** This is a software which can be used through a computer. Through this facility, the typed text is displayed on the computer screen and is also read out aloud. Thus, the learner receives visual and audio presentation of letters, words and paragraphs.

(3) **Speech to text and text to speech software**

27.6 ASSISTIVE DEVICES FOR HEARING LOSS

Some persons with hearing loss can benefit from the use of hearing aids. Several procedures and assessments are carried out before recommending a hearing aid. The assessment should be done by an audiologist. The type of hearing aid recommended would also be different for different people. However, it must also be clear that all persons with hearing loss may not need or benefit from the use of a hearing aid.

Hearing aids are of different types as discussed below:

27.6.1 Body Type or Pocket Model

This hearing aid can be worn in a pocket or clipped to the person's shirt. It is in a rectangular shape. It consists of the microphone, amplifier, power of tone controls and battery case. It is attached to a custom-made ear mould through a wire.

Advantages

1. The controls in this model are easier to operate as they are relatively larger.
2. The body type hearing aid is of reasonable cost.
3. The batteries in the body type hearing aids can be changed more easily.

Disadvantages

1. Since this type of hearing aid is visible to others, the person may not like to wear it, since the fact of his disability would become visible to all.
2. Since these hearing aids have cords, this can lead to difficulties as the cord can break or become loose.
3. These may not be suitable for children who show a lot of movements.

27.6.2 Behind the Ear Hearing Aids (BTE AIDS)

As the name indicates, these hearing aids are worn behind the ear. There are no wires and each ear would have a separate instrument attached to it.

Advantages

1. The difficulties related to the pocket model are eliminated in the BTE aids. Since there are no cords and the aid is behind the ear, others do not come to know that the person is wearing it. Also, there is no risk of the cords getting loose.

Disadvantages

1. The decreased size of the instrument makes adjustments of controls and insertion of batteries more difficult. This is especially so in case of children, elders and person with motor difficulties.
2. BTE aids are more costly than the pocket model.

27.6.3 In the Ear Hearing Aids (ITE Aids)

An option which has come up in the recent years, with the advancement of technology, is the ‘in the ear aids’. This aid fits in the external auditory canal.

Advantages

1. Since they are completely inside the ear, they are more easily accepted by the user because they can hardly be seen.
2. The quality of sound in the ITE aid is better.

Disadvantages

1. These are more costly as compared to the other two types of hearing aids.
2. A person whose fine motor abilities are affected may find it difficult to insert or operate the ITE aids.

Tips for the care of hearing aids

1. Regular cleaning of the ear mould is important.
2. Batteries must be changed at regular intervals.
3. Ear moulds must be changed as the child grows.

27.7 SOME CONSIDERATIONS BEFORE PURCHASING ASSISTIVE DEVICES

Many times assistive devices are prescribed and the person buys them but they are not used. **Some factors which need to be considered before buying an assistive device are the following.** The assistive device should be

- (1) Need based – the aid should fulfill the need of the person/family
- (2) Age-appropriate
- (3) Comfortable
- (4) Safe
- (5) Cost effective
- (6) Made from local resources, as far as possible
- (7) In accordance with the family/cultural context

- (8) Easy/simple to use and maintain/repair
- (9) Easily stored at home (portable, foldable if possible)
- (10) Adjustable in size and degree of support
- (11) Should not isolate the person from others
- (12) Presentable
- (13) Usable in the local environment/terrain

Some points to remember

- Decision about any assistive device or aid should be made keeping in mind the various factors mentioned above.
- The family as well as person with disability should be involved in the decision making process.
- Prescribing and getting an aid is not the end – it needs to be regularly checked for changes in size, its condition and need for modifications.

27.8 LET US SUM UP

- 1 By assistive devices we mean ‘any equipment that allows the person to function more independently by increasing, maintaining or improving his functional capabilities’.
- 1 Assistive devices reduce barriers between the person with disability and his environment, enabling him to have better control over the environment.
- 1 They are mainly divided into the following categories:
Prostheses and Orthoses, Mobility devices; Sensory aids (aids for vision and hearing); Seating/positioning aids (also called postural aids); Aids for communication; Aids for activities of daily living (eating/toileting/bathing/dressing); Education/learning-related aids; Structural modifications; Vehicle modifications; Aids for Recreation
- 1 Persons with cerebral palsy benefit from lower limb and upper limb orthoses such as AFOs, KAFOs, gaiters and arms bands.
- 1 Mobility aids are a type of assistive devices, which help the persons with physical difficulties to move around in the environment.
- 1 Persons with cerebral palsy benefit from mobility devices such as—
Sticks/canes; Crutches; Tetrapods/Tripods; Rolators/walkers; Buggies/Prms; Wheelchairs; Tricycles; Creepers and crawlers; Trolleys; Vehicles
- 1 Persons with cerebral palsy may need low vision aids such as optical aids, non-optical aids and electronic aids.
- 1 Persons with cerebral palsy with hearing loss may benefit from the use of hearing aids.