Occupational Therapy handout

Development of Hand Skills for Children with Down syndrome

Why focus on hand function?

Occupational Therapy is concerned with the development of independence skills. A child's ability to use their hands skillfully may impact many areas of the child's life such as playing, feeding, dressing and handwriting.

Down syndrome and hand function

There are a variety of characteristics associated with Down syndrome that can affect the development of hand function. These include:

Physical Characteristics

- Children with Down syndrome may have varying degrees of muscle tone. Muscle tone refers to the degree of contraction or firmness of muscles. Low muscle tone is when muscles don't have enough tone to hold joints steady, so they appear loose and floppy. Low tone can delay development of head and body control and can decrease a child's ability to reach and grasp. Low tone in the lower arm and hand can make it more difficult for children to position their finger joints to hold an object such as a pencil.

- Tone in children with Down syndrome often stabilises with age, however low tone in early life can encourage ways of moving that may affect later stages of motor development. Motor development is the process of learning how to use muscles in the body to move.

- So, it is important to provide the child with activities that encourage development of stable tone at an early age.

- Children with Down syndrome may have looser joint ligaments. This allows joints to move more than the normal amount. The thumb may have such excess movement such that it is very difficult for a child to hold and manipulate smaller objects.

- A child with Down syndrome may have short arms and legs relative to his/her body. He/she will have further to reach during an activity, which can result in him/her becoming unstable. For example, an activity such as putting on shoes may be more challenging for balance.

- Some children with Down syndrome may have certain hand characteristics including:

    - Smaller hands which make it more difficult for them to grasp and hold large objects.
    - Slower development of the wrist bones and joints may make it more difficult for children to stabilise their hands during the development of grasping patterns, for example, when a child learns to let go of blocks when building a tower; s/he must stabilise his/her wrist to open his/her fingers and release the block.

Medical Conditions

- Some children with Down syndrome may have cardiac problems, which can reduce their activity tolerance and endurance.

- If a child has visual problems their hand eye co-ordination may be affected e.g. when the hands and eyes move together during task completion.

Cognitive ability

- Much of early learning develops through manipulation of objects in our environment. A delay in hand function development can affect a child's growing understanding of the world around her/him. Children with Down syndrome may need extra encouragement for example, modelling or verbal encouragement, to learn fine motor skills.

- Likewise, a child's cognitive level directly impacts on the way s/he uses his/her hands. Despite having the physical ability and potential to use their hands in a particular manner, a delay in cognitive development may result in children not initiating these activities.

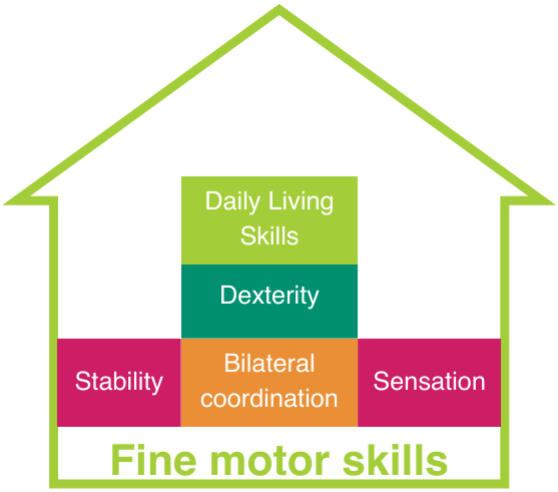
Each child with Down syndrome will develop fine motor abilities at his or her own pace and has his/her own individual strengths and needs. Understanding how and why Down syndrome affects hand function can help us when we are introducing activities.

As outlined above common aspects of Down syndrome including physical characteristics; cognitive development and medical conditions, can impact on hand function.

What skills are required for hand function?

For children to be able to learn to use their hands for activities, for example, handwriting, or dressing, they require foundation skills on which to develop and build. These skills consist of Stability, Bilateral co-ordination and Sensation. In the same way in which a house needs strong foundations on which to build, the foundation skills support the higher levels of fine motor development, which are dexterity and then finally daily living skills.

This is illustrated in the diagram below:



Stability

Stability is the ability of the muscles to maintain contraction to hold a joint steady to allow us to perform a particular activity. For example, stability allows you to hold a camera still while taking the picture, put on your shoes without falling over, and hold your shoulder still while writing. It is a combination of strength and balance.

As children with Down syndrome may have low muscle tone, it will be more difficult for them to hold a consistent degree of muscle contraction over time.

The three main types of stability that children will need to develop to assist function are:

1) Body stability allows the child to move their arms freely without losing their balance.

2) Shoulder stability allows the child to maintain their arms in a particular position whilst moving their hands and arms e.g. cutting with scissors.
3) Hand stability: when the child is using their hands for fine motor activities like writing they need to be able to hold the hand steady whilst allowing movement with the other parts of the hand.

Activities to promote stability:

- Use upright surfaces some of the time, for example, easels, blackboards, whiteboards, slope boards. This will bring the wrist and hand into a better position to practice and will strengthen the movements and control that will be needed for writing.
- Incorporate activities for lifting light items at arm's length, for example, putting things onto a shelf, taking coats off hooks.
- Any pulling or pushing activity that is appropriate in P.E. or 1:1 sessions would be beneficial, for example, row your boat, moving chairs about the room.
- Weight bearing through the hands is great for stability and sensation, for example, wheelbarrow races, commando crawling, rolling on tummy over therapy ball, animal walks.
- Ball games, especially when the child is required to throw the ball overhead (for example, basketball, volleyball) is great for building up shoulder stability.

Bilateral co-ordination

Bilateral coordination is the efficient use of both hands during an activity. Activities such as holding paper while cutting, doing up a zip, tying shoelaces, all require bilateral coordination. Usually with these activities one hand is the 'doer' and the other the 'helper'. This leads on to development of a dominant hand, so either right or left-handedness.

Children with Down syndrome may have difficulty with bilateral coordination due to poor trunk stability (see above). They may not be able to reach out for objects, or across the midline due to limited balance or may be using one hand for support.

Activities to promote bilateral coordination:

- Blow bubbles and reach with both hands to pop them
- Pull cotton balls apart, glue on paper to make a picture
- Tear strips of paper, paste on paper to make a collage
- Squeeze, push and pull on marla or playdough
- Pull apart construction toys (Duplo, Lego) with both hands
- Roll playdough, or Marla play clay, with rolling pins
- Percussion toys: symbols, drums (both hands together), etc.
- Skipping rope
- Ball play: throw and catch with both hands together
- Bounce a large ball with 2 hands, throw or push a ball with 2 hands
- Cut out all types of things with scissors: cut straws and then string up pieces for jewellery, cut playdough or putty, cut up greeting cards and make a collage
- String beads to make jewelry
- Coloring, writing, drawing – be sure the other hand is holding down the paper
- Trace around stencils: the helper hand holds the stencil down firmly while the other draws around the stencil
- Play with pots with handles and spoons for stirring; or with a toy dustpan and brush.

Sensation

We all know the five senses: vision, hearing, smell, taste and touch. However, there are also three other senses:

- Vestibular: the information we receive about movement through a special organ in the inner ear which gives us our sense of balance and spatial orientation, and helps our posture
- Proprioception: the information we receive from our muscles, ligaments, and joints. This tells us where our body is in space, for example, you can close your eyes and touch your nose with your pointed finger because you can sense where each body part is. It also allows you to sense different force or pressure required to pick up or use something, for example, to pick up an egg versus a heavy bag, or the pressure required to hold a pencil to write and colour.
- Interoception: the information we receive from inside our body/organs e.g. hunger, thirst, pain.

The senses of touch and proprioception enable our hands to develop precise coordinated movements. They allow us to tie up our hair, feel for something in our pocket and know where to put our hands to catch a ball without watching ourselves move.

Movement and sensation form a continuous loop. We receive sensory information to tell us to move and once we start to move, we receive sensory information to allow us to adjust our movement accurately. A deficit or delay in the sensory information we receive will affect our movement.

Activities to promote development of sensation:

- Play Simon Says, Follow the Leader and other body awareness games.
- Sing songs that involve actions to copy, for example, I'm a little teapot
- Provide lots of opportunity for running, climbing, jumping and other rough and tumble play.
- Draw pictures or letters in paint, shaving cream, jelly, custard, chocolate mousse etc.
- Arts and crafts activities which involve paint and glue. Tint glue with paint or add sprinkles and the glue becomes the medium. Swirl it around on paper. Find interesting textures for glueing (feathers, textured fabric scraps).
- Sponge art: cut out square chunks of sponge (approximately 1 inch x 1 inch). Have the child dip the sponge into paint and dab on paper.
- Playdough and marla.
- Papier mâché
- Gardening Projects: Planting seeds in yogurt containers, assisting in the garden
- Cooking Projects: kneading dough, mixing up meatloaf, decorating cupcakes, making and mixing granola mixture
- Finding things by reaching into a bag (common objects, shapes, letters, etc.)
- Identifying soft and rough, matching textures
- Tactile domino and memory games.

Children with Down syndrome may have delayed sensory development in their hands for several possible reasons:

1) Processing of sensory information may be slowed – when they are going to pick something up, their muscles may not have time to adjust to the size and shape of the object.

2) There may be differences in the skin that may lead to differences in the way in which sensation is perceived.

Children with Down syndrome will develop sensory discrimination (the ability to detect and feel the difference of different sensory stimuli) through their experiences of daily life. They may also need additional opportunity to experience a variety of textures to be better able to anticipate, discriminate and adjust their hand and arm movements in response to sensory input.

Dexterity

Dexterity is all precise skilful and efficient movements of the hand. It allows us to pick up a raisin, open and close a safety pin and positioning a crayon in our hands to colour. Dexterity includes the following areas:

1) Grasp and release- the ability to grasp and purposefully release an object.
2) Pinch and thumb control- the ability to pick up very small objects with the index finger and thumb.
3) Finger coordination- the ability to move and coordinate their fingers separately from each other.
4) Wrist movement- movements at the wrist help position the hand for function.

Activities to promote dexterity:

- Playdough – Flattening a ball of playdough with the palms of the hands promotes wrist extension, as does rolling out playdough with a rolling pin. Roll playdough into tiny balls by using fingertips of thumb, index finger and middle finger. Use a toothpick or small peg to push into playdough to make a design.
- Drawing at an easel – Using an upright easel or black board (or paper taped to the wall) helps promote wrist extension when painting or drawing.
- Musical instruments: shakers and bells all use wrist movement!
- Use stickers or eyedropper to decorate a picture.
- Pick up and post pennies into a piggy bank
- Play with finger puppets and spinning tops
- Use small tongs to pick up cotton balls, pom-poms, blocks, etc. This will help develop the skill of isolating the movements of the thumb and fingers which is needed for using some scissors. Castanets are also good for practicing this skill. Spraying water guns or plant sprayers.
- Finger games like playing piano on the table with fingers, finger rhymes like Incy Wincy Spider, Where is Thumbkin etc.
- Unscrewing small plastic bottle and placing small objects in.
- Squeezing clothes pegs and placing around ice cream container.
- Sorting small objects into containers according to size, colour, etc.
- Making paper clip chains or placing paper clips onto the side of a card.
- Rolling tissue paper into small balls using only the skill fingers.
- Twist pipe cleaners together to make small shapes and figures.
- When playing games with small pieces, place the small piece on the child's open palm and have them use the small muscles in the hand to manoeuvre it up so it can be used between thumb, index and middle fingers, for example, Lego, bead threading etc.

Daily Living skills

The foundation skills described above all help the child develop independence in activities of daily living. In the same way practicing daily living activities can also develop stability, bilateral coordination, sensation and dexterity. Therefore, children should be encouraged to participate in daily living tasks such as dressing and feeding even if they still require assistance as this will help to develop the foundation skills which will assist the child in other areas.

The ‘Finishing Touches’

As in the construction of any house, the finishing touches always seem to take the longest. The refinement of the upper-level skills, and the development to make everything work ‘right’ may take years to complete. The development of fine motor skills begins early in infancy and continues until adolescence.

****SAFETY CONSIDERATION****

There is some evidence to suggest that children with Down syndrome may be more likely to have an instability in the vertebrae of their neck which could place them at increased risk of a spinal injury in the event of trauma to this area. Caution should be used with these activities to ensure that the child does not experience a sudden impact e.g. use appropriate mats and supervision

The activities listed above are suggested activities only, the list is not exhaustive nor is it intended that the child should be engaged in all the above activities daily. Some of these activities should be incorporated into the child’s daily routine if possible.

Do not force a child to engage in an activity that they do not like, particularly a sensory activity. It is important that activities which the child enjoys or finds meaningful are chosen as they will be more likely to engage in activities which they enjoy for themselves rather than just for their therapeutic potential.