Task Oriented Movement Training for Infants and Toddlers

Activities for training standing with hand support

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A dynamic systems task oriented approach to training movement

In this manual I describe a range of training activities designed to improve infants' and toddlers' ability to perform tasks on the stand-and-cruise-with-hand-support development pathway.

A **task oriented training approach** starts by identifying the infant's ability to perform progressively more difficult tasks along the stand-cruise-walk pathway.

A **dynamic systems approach** means that all aspects of the interaction between the task, the infant and the environment are kept in mind when figuring out why the infant is experiencing difficulties and what can be done to adapt the task and environment to allow the child to succeed.

Once the infant's or toddler's mastery of tasks along the stand-cruise-walk pathway has been identified, the next step is to provide them with many opportunities for extending mastery of ever more difficult and challenging tasks.

Principles of a dynamic systems and task-oriented approach to intervention

The dynamic systems and task oriented approach to intervention is informed by the following ideas:

1. Family centered care and the involvement of parents in selecting goals and providing opportunities for practice of movement skills is essential to success.
2. Therapy always starts with the infant's present abilities - what they can do at this present moment, and how this creates an opportunity for learning to do more.
3. An emphasis on training intensity, repetition and many daily opportunities for practicing a task in a variety of contexts.
4. Self-initiated action, along with exploration of possibilities for doing things, supports and enhances motor learning.
5. Intrinsic motivation, curiosity, and the drive to explore and interact with people and objects supports learning new movement skills.
6. Promoting enjoyable and meaningful social interaction and communication is central to intervention and supports learning of motor task.

Morgan, C et al (2021). Early Intervention for Children Aged 0 to 2 Years With or at High Risk of Cerebral Palsy: International Clinical Practice Guideline Based on Systematic Reviews. *JAMA pediatrics*, *175*(8), 846–858.
Morgan C, Novak I, Dale RC, Guzzetta A, Badawi N. GAME (Goals - Activity - Motor Enrichment): protocol of a single blind randomised controlled trial of motor training, parent education and environmental enrichment for infants at high risk of cerebral palsy. BMC Neurol. 2014 Oct 7;14:203

Learning to stand with carer support

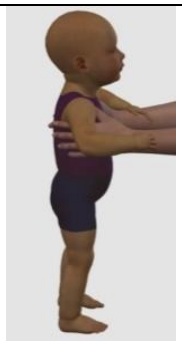
When held upright and supported under the axillae or around the upper chest by a carer, typically developing infants from 1-2 months will intermittently take weight on the lower limbs.

From 4-5 months infants start to actively straighten the knees and take weight on the feet when they are supported upright around the chest or waist.

This early standing practice strengthens the infant's leg muscles and gets them used to taking weight on their feet. It also provides the movement brain with sensory input needed for building the internal models of the lower limbs needed for controlling weight bearing in standing. (Kornafel et al 2022)

Infants also learn to keep the head and trunk erect. The amount of trunk control to keep the head and trunk erect depends on where on the trunk the support is provided. With support under the axillae the child needs to support the head on the trunk and extend the hips to remain erect. With support around the waist more control of the position of the upper trunk is needed.

From 4-5 months infants also learn to stand when holding onto a carer's hands or clothing.

		
Standing with support under the axillae.	Standing with support at waist level.	Standing holding onto a carer's hands.

Activities to train standing with carer support around the chest

To practice standing with carer support, let the carer sit on the floor or on a chair, hold the infant around the chest and lift them up into a standing position. Adjust where on the trunk support is provided depending on the infant's ability to maintain an erect posture.

The infant should straighten the knees and support their weight on the lower limbs with the knees extended. Some infants like to bounce up and down by bending and straightening the knees.

To encourage the infant to take weight on the lower limb you can bounce them up and down a little – this lifting and lowering action will sometimes elicit a supporting response in the lower limbs.

If the infant does not straighten the knees, let the carer turn the infant around so that they are supported against the carer's chest. Show the carer how to use one hand to support the trunk and one hand to hold the knees straight. It is always a good idea to provide the infant with something interesting to look at, as this will often increase their overall postural tone.	

Activities to train standing with carer holding the infant's hands

Once the infant is able to keep the trunk erect and support their full weight on the lower limbs when supported around the chest, you can start to practice standing with the infant holding the carer's hands.

		
Pulling up to standing	Stand holding the carer's hands	Standing holding carer's clothing

In this position the infant needs to control the alignment of the trunk and lower limbs and keep the centre of mass (COM) aligned over the base of support (BOS). Postural sway is seen as a forwards and backwards movement of pelvis relative to the BOS.

It is also useful to encourage the infant to hold onto the carer's clothing and push on the carer's chest. With practice infants start to let go of one hand and balance holding on with just one hand.

Standing with tummy resting on a flat support surface

Standing supporting on hands with the trunk erect can be difficult for infants with developmental delay. This may be due to weakness of the trunk, hip and knee extensors. (Kornafel et al 2022) It may be because they have not had much experience standing when supported by a carer. Some children do not respond with hip and knee extension when supported upright by a care giver – instead they bend the hips and knees.

One way to get these children to stand with hand support is to let them stand facing a hip-high support surface and lean forwards with the chest leaning on the surface. The child will usually take some weight on the forearms and hands.

Initially you may need to support the knees in extension.

		
Standing with tummy resting on flat support surface	Taking some weight on forearms	Starting to reach with one hand

Provide the child with toys within easy reach of their hands, or something interesting to look at. The reaching actions will usually elicit some trunk extension and the child may push down on one or both hands and lift the trunk up of the support surface.

Once the child has started to keep the knees extended and keep their feet on the floor encourage them to reach in different directions.

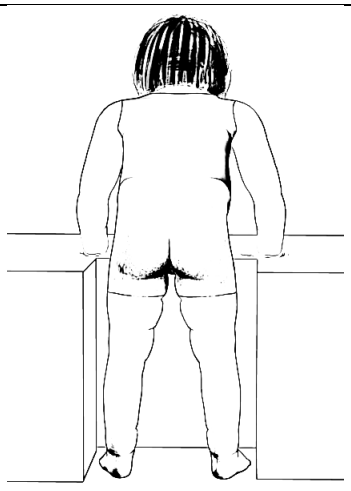
Take time to play reaching games, especially games that get the child to reach upwards with one hand.

With time the infant will start to push up on the arms and also start to lift the chest up off the support surface.

Using boxes to stop the child from toppling sideways

For children who tend to topple sideways, it is useful to let them stand between two weighted boxes. The boxes will stop the child from falling sideways and encourage then to right themselves again if they do.

Remember: Stay close by and be ready to catch the child if they suddenly fall over.

Training balance in standing erect with hand support

When first standing with hand support on furniture typically developing infants explore different ways to distribute their on the upper and lower limbs so as to maintain their balance when turning to look or lifting the hand to reach to the side or backwards.

Two patterns of weight distribution emerge: an ipsilateral and a cross-over (contralateral) pattern.

The ipsilateral pattern

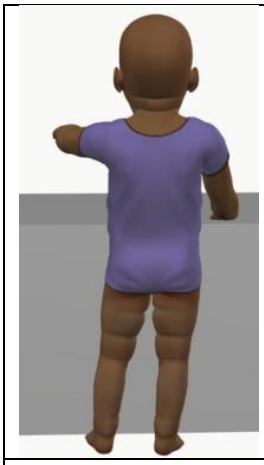
When the right arm is lifted, weight is shifted onto the left (contralateral) upper and lower limb.

This narrows the BOS in side-to-side direction. The distance of the lateral shift of the pelvis over the loaded lower limb determines the stability of the position.

The cross-over pattern

In this pattern, when the right arm is lifted the weight is shifted to the right lower limb and left hand.

With practice children discover that a cross-over pattern of weight distribution is more stable in most circumstances.



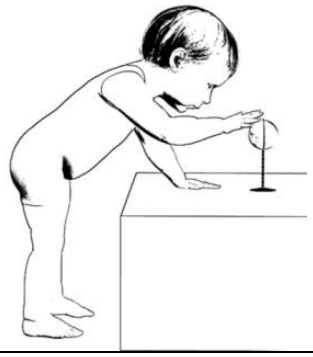
The ipsilateral pattern

The cross-over (contralateral) pattern

Activities for encouraging weight shift when reaching in hand-support standing

Typically developing infants will pull themselves up to standing using available support surfaces such a low table, beds and sofas. Once in standing they start to explore their ability to reach for toys, turn to look in different directions and take small steps.

Infants with developmental delay may stand with the knees locked into extension and their hands firmly planted on the support surface with limited attempts to reach for toys. These infants need dedicated practice time to encourage them to explore reaching with effective weight distribution to maintain their balance.

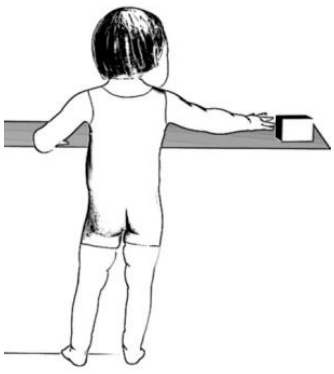
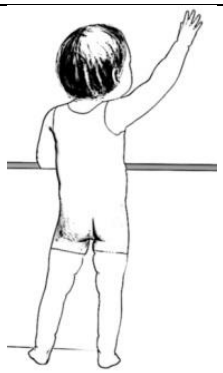
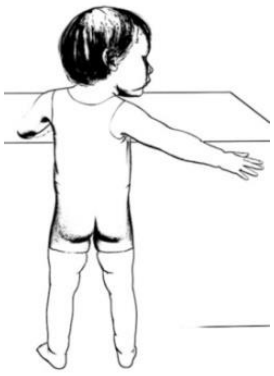
If the child tends to fall easily when standing erect supporting on a chest-high support surface, it is a good idea to let them stand facing a lower support surface with the chest tiled forwards and the hips in some flexion. **See below: Lowering the height of the support surface**	 Standing facing a lower support surface.

Training activities to encourage reaching and weight redistribution

Let the child stand facing a suitable support surface. Encourage the child to reach for a toy or other interesting objects placed within easy reaching distance. Place the toy in different locations to encourage reaching in different directions and exploring different patterns of weight distribution.

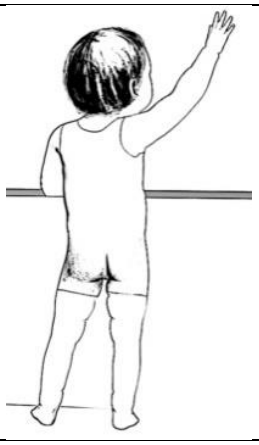
Select activities that encourage repeated reaching – including knocking over tall plastic bottles, picking up and throwing a ball, posting activities. (See activities for encouraging repeated reaching.)

Once the child has learned to maintain balance when lifting one arm to reach for a toy within easy reach, place the toys a little further away to encourage weight shift to extend their reach. Reaching up and reaching back also challenges their balance.

		
Reach to the side	Reach up	Reach back

Reaching backwards to encourage weight shift

Some children keep the knees locked in extension and do not initiate weight shift when reaching to the side. I find placing a toy so that the child has to reach backwards encourages rotation of the trunk and pelvis and this will often unlock the knees and lead to weight shift.	

Reaching up high is another way to destabilize the fixed extension of the knees. Present a toy so that the child needs to lift the hand high above the head. This will often lead to weight shift onto the ipsilateral LL.	

Lowering the height of the support surface

Letting the child stand facing a hip high surface can be useful if the child is having difficulty balancing when hips are extended and the trunk is erect.

In this position more weight can be carried by the upper limbs and the BOS is longer in the anterior-posterior (sagittal) direction. In this position let the child reach for toys placed within easy reach, and progress to positions that require the infant to reach further by shifting weight over the lower limbs.	 Standing facing a hip-high support surface

As the infant's control and balance improves, raise the height of the support surface to encourage bringing the trunk more erect with more hip extension.

Children who stand with their feet very wide apart

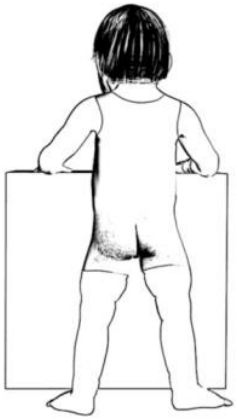
Children with hypotonia and joint hypermobility often have limited hip adduction when the hips are in extension, which means that standing with the feet aligned just wider that pelvis width is uncomfortable.

These children will usually stand with their feet wide apart, the knees may be locked into hyperextension with the feet turned out and pronated.

Because standing with the feet wide apart and the knees locked into hyperextension is a very stable position, lateral weight shift is difficult to initiate as it requires adduction of the hip to bring the COM over the one lower limb.

Letting the child stand with the feet parallel and pelvic width apart and blocked by a sandbag or weighted box provides the child with experience of standing with the hips in a more adducted position and also starting to take more weight onto one lower limb in readiness for stepping sideways.

In this position playing reaching games will encourage weight shift. With the feet positioned forwards rather than in lateral rotation the ankle muscles become active.

	
Standing with feet wide apart and turned out.	Standing with feet hip-width apart and facing forward.

Standing between high blocks

Some children when starting to practice standing with hand support very easily fall over to the side.

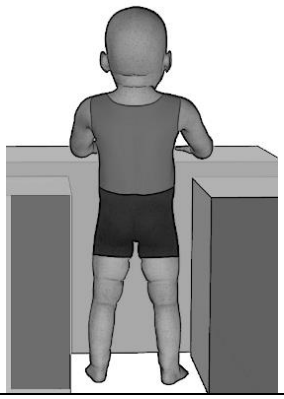
If this is the case, you may find it useful to position a weighted cardboard box or heavy foam block on either side of the child.

If the child tends to fall backwards, position another box behind the child.

Start with the blocks positioned close to the child so that they limit sideways movement of the pelvis and if the child does fall to one side they are able to use their hands to right themselves again.

As the child's balance improves and they are able to stay erect when reaching or looking around, move the blocks further away so that they do not provide support but will block a fall to the side.

This allows the child to explore ways to shift their weight when reaching without the risk of falling very far.

	
Standing between high weighted boxes	Boxes stop the child from falling

Pull-to-stand and standing up from a step

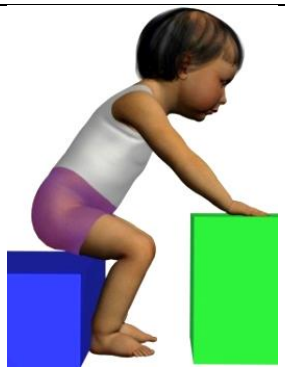
Typically developing children usually learn to pull themselves up to standing with hand support from sitting on the floor. This action requires good muscle strength, coordination and postural control.

	
Standing up by pulling with the upper limbs and pushing up with the lower limbs	Standing up through half kneeling

If a child does not have the strength and coordination to pull up to standing from sitting on the floor, practicing standing up from sitting on a step is an effective way to strengthen the hip and knee extensors and improve balance control.

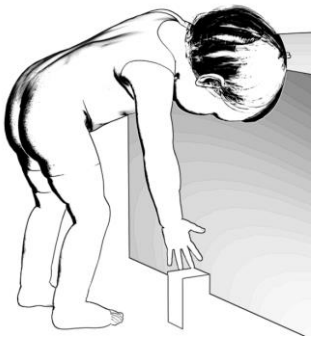
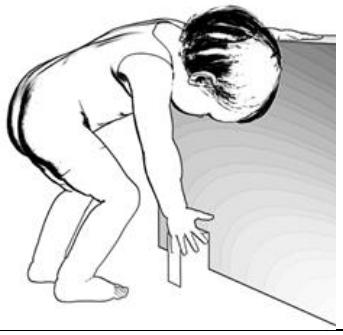
Let the child sit on a step or stool that is about the child's knee height and facing a stable surface (bed or sofa). Encourage the child to place their hands on the support surface and stand up. It helps if there is something for the child to pull on.

You can make standing up and sitting down easier of more difficult by changing the height of the bench or the support surface.

	
Reaching forward and up to get weight onto feet	Standing up from sitting on a bench

Learning to reach down

One of the important abilities children learn when standing with hand support is to reach down to pick up toys from the floor. Initially the child flexes the hips keeping the knees in extension and tips the trunk forwards.

	
Reaching down, bending from the hips	Reaching down, bending hips and knees

As a child's standing balance and muscle strength improves they also learn to reach down by tipping the trunk forwards and flexing the hips and the knees.

As the child tips the trunk forwards and flexes the hips and knees, the COM is shifted in a posterior direction as the child learns to balance over the BOS provided by the feet and the one hand.

This action requires controlled eccentric contraction of the knee extensors followed by extension of the knee brought about concentric contraction of the knee extensors..

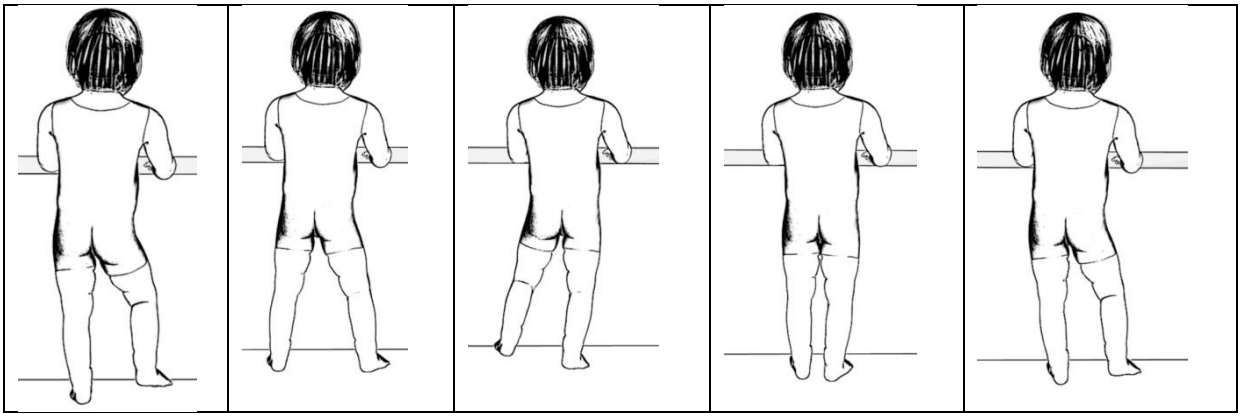
Activities to train reaching down to pick up toys

Let the child stand facing a chest-high low table or sofa. Place a closed box that is about half the height of the table to one side of the child.

Put a toy on the box and encourage the child to pick the toy up. To begin with the child may keep the knees straight and bend at the hips. But usually with practice the child learns to flex the knees. You can then make the exercise more difficult by putting the toy on the floor	
	Bending the hips and knees to reach down

Cruising and stepping across a gap

Once TD infants have learned to take a single step sideways they start to take several consecutive steps. Cruising differs from stepping in that the infant takes a series of steps with a defined stance and swing phase for each lower limb.



Repositioning of the hand on the support surface is synchronized with the lower limb movements in an antiphase manner. With experience this antiphase coordination improves and speed of stepping increases.

This antiphase movement of upper and lower limbs is the same as seen in crawling. However recent research by Ori Osmy and Karen Adolph from New York University has shown that the emergence of well-coordinated antiphase cruising is not influenced by crawling experience and competence.

Infants also learn to coordinate their limb movements to allow them to traverse across gaps of ever increasing size.

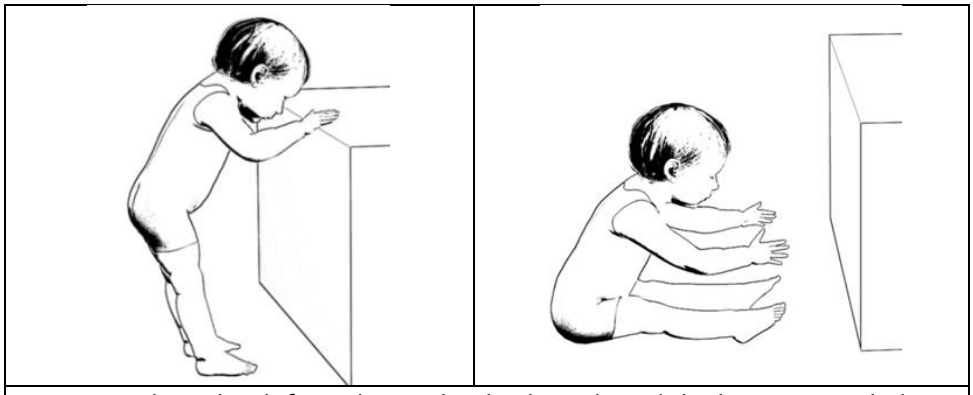
Activities for encouraging cruising

Let the infant stand facing a suitable support surface that is 1-2 meters wide.

Place toys out of reach so that the child needs to take several steps to get close enough to get hold of the toy. Once the child has learned to take several steps along a solid support surface position two or three chairs or boxes with gaps between them so that the child needs to reach across the gap to take the next step. Move the chairs further apart to make the activity more challenging.

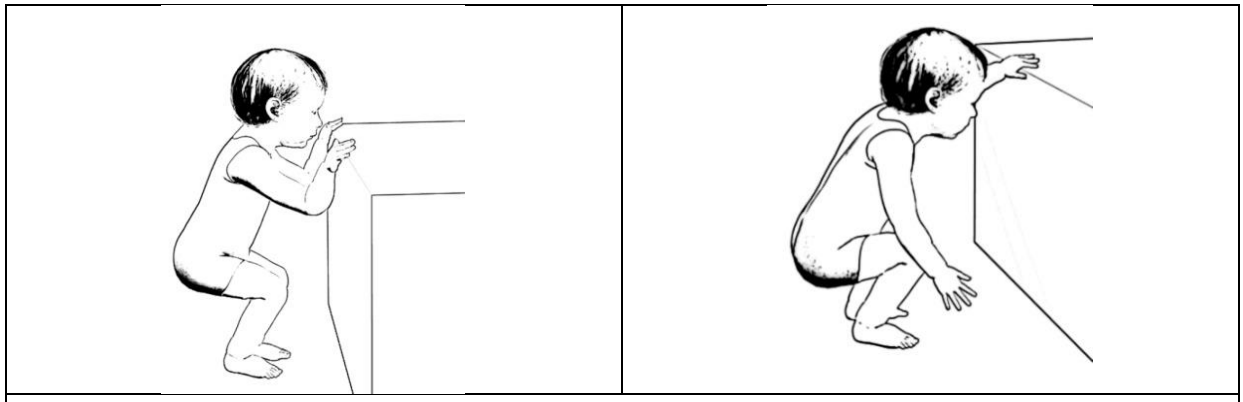
Learning to sit down

When infants first start standing with hand-support they sit down by shifting their pelvis backwards and sitting down with the knees extended.



Sitting down by shifting their pelvis backwards and the knees extended.

With practice they learn to flex the knees, shift their weight backwards over the feet to keep the COM aligned over the base of support and lower the buttocks to the floor.



Bending hips and knees to sit down

Activities for encouraging letting go and standing without hand support

Children sometimes need extra practice to encourage them to lift both their hands off the support surface. To do this they need to balance themselves over the small base of support provided by their feet and start to activate the ankle muscles to counteract the changing position of the LOG relative to the ankle flexion extension axis.

Let the child stand facing a support surface and provide them with toys that and games that need two hands to manipulate or achieve a desired outcome.

Here are some ideas

- Lifting a medium sized ball and putting it into bucket.
- Building a tower of boxes of a size that needs two handed grasp.
- Posting small balls into a long tube.
- Singing action songs and clapping hands.
- Drumming on a box with two hands.
- Pulling a scarf out of a plastic bottle with a wide mouth. And then stuffing it back again.

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