Evaluating the Client With Physical Disabilities for Wheelchair Seating

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Positioning through wheelchair seating allows many severely physically disabled individuals to use their motor skills to access technical aids. In the last 10 years, many products relating to wheelchair seating have been developed and are now being used.

This article outlines evaluation and prescription guidelines that lead to the accompanying recommendations for seating. Categories for matching disability type/severity to seating methods are presented.

Within the last 10 years, rapid advances in technology have led to a surge of information and new products. People with severe physical disabilities have particularly benefited from this situation. Technical aids, such as powered wheelchairs and electronic communication aids, have allowed children and adults with severe physical disabilities to gain independence in selected areas. This technology boom has considerably broadened the ability of occupational therapists to assist this population and has permitted therapists to reallocate time once spent on fabricating devices to providing direct treatment and training.

The number and types of technical aids available have increased so dramatically that therapists now have many products from which to choose. Although most therapists do not have the time or need to be familiar with all the details and functions of all of the technical aids available, they must know how to evaluate an individual for technical aid use. With their knowledge of the individual’s needs, therapists can use outside resources (e.g., dealers specializing in durable medical equipment) in locating the appropriate aid. A prerequisite for the functional use of technical aids is proper positioning, usually in a seated position, because this is often the most functional, practical, and socially acceptable position in a school or work setting. An appropriate seated position facilitates the optimal use of existing motor skills to access the technical aid. Once the desired positioning is obtained, specific motor control sites can be evaluated. The combination of seating with other technical aids forms a system.

Evaluation for Seating

To determine the need for a technical aid such as wheelchair seating, the client’s areas of function and dysfunction are screened and evaluated. The therapist obtains neuromotor and orthopedic summaries, determines sensation status and gross/fine motor abilities, assesses strength and activities of daily living status, and compiles work/educational and psychosocial histories.

Neuromotor Summary
The neuromotor summary includes an evaluation of tone and presence of primitive postural reflexes and focuses on their effects on the functioning of a person when he or she is seated. The reflexes usually involved include the asymmetric tonic neck reflex, symmetric tonic neck reflex, tonic labyrinthine reflexes, and positive supporting reaction. In evaluating tone one determines if the person is generally hypotonic, hypertonic, athetoid, or mixed. For example, most clients diagnosed as spastic quadriplegic dem-
onstrate hypertonic extremities with a hypotonic trunk.

Orthopedic Summary

When examining a client's orthopedic status, the therapist must determine which deformities are realistically correctable and which simply must be accommodated. For example, a person with a slight (10°) scoliosis can be supported in a fairly upright position that closely corrects the curve of the spine. A person with a 30° or greater scoliosis would need to be reclined to either correct or comfortably accommodate the curve. In many cases, the line between an attempt to accommodate and to correct is a fine one. If the therapist is unsure, the person's comfort over a period of time is the guide.

Sensation Status

In this evaluation, the therapist attends closely to areas of impaired or absent sensation, especially bony areas such as the area over the ischial tuberosities, which will be contacted by the seat and/or back of the seating insert. Persons with normal sensation and severe orthopedic deformities involving many bony prominences who cannot accomplish weight relief are treated as if they have no sensation.

Also important in the evaluation is how long a client sits during the day, who supervises skin care, and how frequently this is done. A person who stays in the seating system for the entire day requires a different type of surface than one who is in the system for only a half hour at a time.

Activities of Daily Living, Gross and Fine Motor Abilities

The person's ability to independently carry out activities of daily living (ADL) is evaluated primarily so that the seating provided does not hinder independence. For example, if the person can independently pivot transfer forward out of the wheelchair from a certain seat height from the floor, the therapist would ensure that this seat height is maintained. Occasionally, the maintenance of a client's independence may compromise or modify the therapeutic goals of seating. Once an appropriate seating system is implemented, the ADL and fine motor skills can be reevaluated to determine increases that have been obtained in functional abilities from the support.

Education/Work History

An education history includes the client's current educational level as well as the plans of the school personnel/family/individual. Clients with severe physical disabilities who cannot communicate, write, or independently access a computer, should be given opportunities to meaningfully interact with their academic environments. In these cases, receptive communication skills are carefully evaluated by a speech pathologist/occupational therapist team to determine the need for an augmentative communication aid. The need for computers and other aids, such as special trays for communication systems to assist the client in the academic environment, is addressed as part of the client's overall seating system. This ensures a seating system that is a functional environment for the client.

Another part of the education history is an assessment of transportation needs. Many school districts and colleges provide vans or buses with lifts and wheelchair tie downs for transportation. The wheelchair tie down system affects the type of wheeled base chosen for the seating system. If powered mobility is a consideration, both school and home transportation and accessibility are examined.

The person's workplace and work habits are also evaluated to ensure that the recommended technical aids will be compatible. This is particularly important with regard to wheelchair height versus work space heights.

Psychosocial Considerations

Functional seating systems, must be "user-friendly." Systems that require continuous adjustments, have removable parts that are easily lost, or are difficult to transport, are less likely to be used in the manner intended by the therapist. Cosmesis, an important aspect of seating, is sometimes overlooked by therapists. For example, the choice of covering can be very important to families, even if it is not very important to the provision of seating. The seating system should be considered an extension of the client's tastes and self-image. If it meets only the needs of the provider, in terms of usability and appearance, the system will likely be used little.

Prescription Process

Before a specific piece or method of seating technology is matched to a client's needs, positioning goals are established. There are therapeutic guidelines of positioning in sitting (Bergen & Colangelo, 1985; Taylor & Trefler, 1984). For example, positioning usually begins with support at the pelvis, then continues to the lower extremities, the trunk, head, and shoulder/upper extremities. The guidelines help the therapist in using a systematic approach. The therapist ultimately relies on his or her observation skills, experience, and ability and willingness to simulate and attempt various postures.
Positioning

In general, the goals of seating are to minimize the effects of abnormal tone and reflexes; accommodate, delay, or prevent the development or progression of orthopedic deformities; increase functional skills; accommodate for impaired sensation; and provide comfort.

The Pelvis

With few exceptions, positioning begins with support at the pelvis. The position of the pelvis dictates body position throughout seating arrangements. The pelvis is positioned and held in midline to ensure a stable base of support before attempts are made to position the remainder of the body. A lap belt mounted at about 45° is used to maintain pelvis positioning. A lap belt mounted closer to an 80° to 90° angle may be necessary for those with fixed posterior pelvic rotation. Deformities about the pelvis should, for the most part, be accommodated within the seating with the goal of a balanced trunk and head position.

Lower Extremities and Feet

The client's lower extremities are positioned in neutral rotation at the hips, with 90° flexion at the hips, knees, and ankles. An angle greater than 90°, particularly at the hips and knees, encourages a posterior pelvic rotation posture, which results in the client's sliding out of the seat. This is especially noticeable in clients with increased lower extremity extensor tone. Failure to maintain 90° or less at the hips and knees often results in a lower extremity extensor pattern with posterior pelvic rotation, internal rotation, adduction and extension at the hips, and extension at the knees. Knee flexion tightness (hamstring tightness) is accommodated to avoid posterior rotation at the pelvis. In this case, flexion of less than 90° at the knees will allow the client a more neutral pelvic position.

Deformities of the lower extremities such as a "windblown" deformity (adduction contracture of one hip, abduction of the opposite hip) are accommodated so that the desired end result will be a forward facing position of the client's head and trunk.

Tendencies toward adduction of both hips is discouraged by positioning the client in wide abduction to lessen the opportunity for hip subluxation or dislocation. Pommels (abductors) are placed distally, so as not to encourage adduction by stimulating the medial thighs. The client's feet are optimally positioned at 90° or less. Foot straps placed at a 45° angle encourage pressure toward the heel of the foot rather than only on the ball of the foot. This inhibits the elicitation of a positive supporting reaction. Extreme foot deformities are either accommodated or braced.

The Trunk

Depending on the client's control of his or her trunk, midline support can range from a low profile trunk support, for clients who simply need a tactile reminder of where midline is, to rigid trunk support for those who have little or no trunk control. Support for clients with spinal deformities, such as scoliosis and kyphosis, is carefully evaluated to ensure that corrective forces placed on the individual are tolerable. Severe deformities should always be accommodated comfortably by using a seating technique that allows for contacting as much surface area as possible. Usually, when supporting a client with scoliosis, some degree of recline (maintaining a 90° hip angle) is necessary to alleviate some of the effects of gravity on the spine, thus making lateral support more comfortable and tolerable.

Anterior trunk support is necessary for individuals who cannot maintain an upright position independently for an extended period of time but require a more upright position for functional or therapeutic reasons. Chest belts are helpful for clients who simply require a gentle push into an upright position. Chesi panels, harnesses, or other 4-point supports (placed over the shoulders and laterally around the trunk) are useful for clients who tend to come forward with their shoulders or who tend to elevate their shoulders to obtain stability.

The Shoulders, Upper Extremities, and Head

Shoulder protraction is provided occasionally to assist in relaxing the client's extensor tone. Shoulder protraction "wings" that are added to the back or the lap tray of the wheelchair, encourage a more midline upper extremity posture. A person's head position often dictates his or her overall body tone, particularly in the trunk and upper extremities/shoulder girdle. Position in space of the client's head must be examined in relation to the effects of the shoulder girdle, upper extremities, and trunk (Bergen & Colangelo, 1985). Reclining an individual with his or her head in the same plane as his or her trunk often results in increased trunk and shoulder girdle extensor tone because of the effects of the tonic labyrinthine supine reflex. In addition, the symmetrical and asymmetrical tonic neck reflexes can affect positions of the trunk and upper extremities.

A hyperextended position of the head, with a kyphotic posture of the upper trunk, is a difficult positioning problem. This position indicates overall trunk hypotonicity, resulting in a tiring and nonfunctional position of the head. Reclining the client, maintaining the client's hip angle, but bringing his or her head to a more upright position can alleviate the effects of grav-
Another difficult functional problem exists when the client has a flopping head or head that pulls into flexion. Persons with this problem are observed to have their heads “hanging down,” no matter what the angle of recline. Some clients cannot be reclined because their functional position is upright. Many devices, including snugly fit head straps, chin cups, and soft cervical collars, have been used to resolve this problem. Any device that is placed about the head should be applied and observed with care, because it can affect tone, neck position, and swallowing. It is important that the therapist carefully observe the effects of the body’s position in space on the head and vice versa.

The Seating Simulator

The ability to simulate postures and positions in space is an important part of the evaluation. Holding the client on an examining table in various positions is an inaccurate assessment method and does not provide information about the effects of positions on tone, realistic forces that can be applied, initial acceptance of positioning, or the effects of positioning on the client’s function. The use of a seating simulator helps provide the therapist with the technical information required for assembling the system, providing a concrete method of communication between the therapist and the technical person.

Simulators should have angle in space adjustments, adjustments in thigh length, hip angle, and back height, as well as varying shapes and sizes of seat and back components, lap belts, head rests, chest supports, and footrests. In addition, a variety of powered and manual chairs should be used in the simulation, although they should not be recommended without the therapist having an opportunity to evaluate them first. The simulator concept has been built into several seating systems, including the Pin Dot Contour-U system1 and the Modular Plastic Insert Seating System.2 By using a simulator, the therapist can know by the end of the evaluation what the functional position is, and what types of equipment may be appropriate.

Matching Devices to Needs

Once the desired posture is found through evaluation, the therapist investigates which devices will achieve the desired goals. Functional and therapeutic goals must be defined before the hardware can be selected.

Interfacing factors that form a basis for decision making toward a specific seating device include (a) the presence and degree of abnormal tone and reflexes; (b) the amount of postural control that can be obtained and sustained by the client; (c) functional skills resulting from external postural control; (d) the potential for, or existence of, orthopedic deformities; and (e) sensory status (Hobson, 1984). Clients are classified as either mildly involved, moderately involved, or severely involved.

A mildly involved person has mild tone/strength problems (the ability to readily maintain symmetrical postures) and minimal orthopedic involvement (no limitations in range of motion in sitting). A moderately involved person has moderate tone/strength problems manifested by an inability to maintain functional or symmetrical postures; moderate orthopedic involvement, which could include a flexible scoliosis of less than 30°; flexible kyphosis; dislocated hip with a leg length discrepancy of less than 2 in.; contractures of the hips/knees of less than 110°; and feet that cannot maintain a plantigrade position. A severely involved person has severe tone/strength problems that would prevent him or her from obtaining or maintaining symmetrical postures; severe, fixed curvatures of the spine (greater than 30°); and/or fixed deformities about the pelvis or lower extremities greater than those previously described.

A client need not fit all of the descriptions to fall into a category. For example, a person could be defined as severely involved if tone alone were severely impaired, but no orthopedic deformities were present; such is the case with many individuals with athetoid cerebral palsy.

Sensation is considered separately from tone and strength. Aside from the obvious categories of absent, impaired, and normal, the client’s ability to independently relieve pressure and move away from discomfort is also considered. Many severely involved persons are categorized as having impaired sensation because of the combination of severe, bony deformities and their inability to move away from discomfort. In choosing hardware, no one piece of equipment is appropriate for every case. The careful evaluation of a person’s needs combined with a knowledge of available equipment is likely to lead to an appropriate match.

Mildly Involved Clients

Generally, linear, commercially available components can be used to seat mildly involved persons. These systems have modular, interchangeable parts that can be readily adjusted for growth or change. Functionally, they provide midline stability and en-

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1 Manufactured by Pin Dot Products, 2215 Belmont, Chicago, IL 60618.
2 Developed by the University of Tennessee-Memphis, Rehabilitation Engineering Program, 682 Court Avenue, Memphis, TN 38163.
courages maintenance of midline postures. Examples of this type of system would include the Pin Dot C. P. Seat, the Orthokinetic Travel Chair, the Safety Travel Chair, or commercial cushions, such as the Jay cushion.

Examples of mildly involved individuals would include:

- A child with spastic, diplegic cerebral palsy who is partially ambulatory but requires a wheelchair with a flat seat for distance mobility. With a flat seat, the child can have the proximal stability necessary for her or him to obtain upper extremity function to propel the chair.
- A low spinal cord level paraplegic who requires a simple cushion in a lightweight wheelchair to provide pelvic stability and assist in maintaining skin integrity.

Moderately Involved Clients

Custom-contoured systems or combinations of linear and contoured systems can be used to seat moderately involved clients. The main goals with this group are to correct and/or accommodate orthopedic deformities and to provide enough stability for the person to be functional. A custom approach is necessary to closely approximate body contours. Examples of appropriate seating approaches include Pin Dot Products' Bead System, the Foam-In-Place system, and hybrid solutions, such as a custom Jay cushion with a foam and plywood back.

Examples of moderately involved individuals would include:

- A child with spinal muscular atrophy with no orthopedic deformities. Although the child has no deformities, he or she requires very aggressive midline support to obtain distal function. In addition, because the child cannot relieve weight and is very thin, he or she needs a surface that can assist in providing pressure relief. A midline linear back could be used, but a custom-made seat would also be necessary to provide pressure relief.
- A head-injured adult with hip and knee extension contractures, kyphotic trunk posturing, poor head and trunk control, and a dominance of overall extensor tone. An intimately contoured approach would accommodate the individual's deformity, control tone, and provide controlled resiliency in the sitting surface to decrease the possibility of developing pressure sores.

Severely Involved Clients

With few exceptions, severely involved clients require a total customized approach to control severe tone dysfunctions, accommodate severe bony deformities, and/or accommodate for sensation problems. The sitting surface that contacts the body must closely approximate the person's body contours, particularly if severe orthopedic deformities are present, to prevent the development of pressure areas over bony deformities. Examples of seating approaches used with this population include the Shapeable Matrix System, the Foam-In-Place system, and Pin Dot Products' Contour-U System.

Examples of severely involved individuals include:

- A client with high tone athetosis who has a minimal orthopedic deformity who would require aggressive contouring to provide midline stability because of the intensity of the tone. The intensity of tone and retained abnormal reflexes can dictate the need for a less resilient sitting surface to protect the integrity of the skin.
- A young man with advanced Duchenne muscular dystrophy and severe pelvic obliquity and spinal deformity who would require a contoured seat to comfortably accommodate the orthopedic deformities. The back of the seating insert, however, could be less contoured because some trunk movement is necessary to obtain upper extremity movement and placement.
- An adult with severe spastic quadriplegic cerebral palsy, multiple, severe orthopedic deformities, and no head or trunk control who would require a very contoured seating system to comfortably accommodate orthopedic deformities.

Summary

Within the last 10 years, technology has provided occupational therapists with new approaches for treating severely physically disabled children and adults. Positioning is often the first step in the overall provision of technical aids. Presently, there are many approaches to providing seated positioning that do not...
involve costly and time-consuming fabrication by the occupational therapist. A careful occupational therapy evaluation, with input from other team members, is necessary to clearly define goals for the seating device. Once these goals are defined, the therapist can investigate devices by contacting medical equipment dealers/manufacturers and by obtaining samples and in-services on seating devices and wheelchair bases. The goal is to fully understand the characteristics and limitations of each device, wheelchair, and seating approach.

References


Other Resources


RESNA—Special Interest Group on Seating. Jessica Presperin, Co-Chair. PO Box 14813, Chicago, IL 60614.