Improving Upper Body Control

An Approach to Assessment and Treatment of Tonal Dysfunction

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Preface

This book will help you assess and treat patients with neurological impairment resulting in dysfunctional or abnormal muscle tone.

The material concentrates on achieving upper extremity function for personal autonomy. However, because the upper extremities work in synchrony with the rest of the body, it covers significant aspects of whole body movement as well. Thus, though the book is written by an occupational therapist, physical therapists and speech pathologists will find the information applicable to gait and respiration.

This information can be applied to patients of any age or size. The illustrations alternate the use of small and large bodies so you can generalize your visualizations.

The intervention strategies presented reflect a strong neurodevelopmental treatment orientation. However, the analysis of component parts of movement and the review of significant aspects of normal and abnormal development have evolved from the integration of anatomical and kinesiological perspectives. Our kinesiology illustrations are intended to help you visualize the position of the muscle and the related skeletal parts. As you provide treatment, these visual images will guide the location and direction of your touch.

Treating the patient who has had a neurological injury is a challenge because we cannot remove the central nervous system lesion. The premise of the neurodevelopmental treatment approach is that we can change function by giving the sensorimotor system more appropriate cues. When we work with an immature central nervous system, we are guiding the original developmental process. When we work with a matured system, our focus is on retraining. In both cases, the therapist's sensorimotor system relates to and modifies the sensorimotor system of the patient. It becomes a graceful and fluid interaction.

Therapy is like good art and science. It is often a matter of taking advantage of the fortuitous "accident." Enjoy.
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I have been the recipient and victim of many "therapeutic" hands, many of them not at all therapeutic. The touch of most medical people, for example, is fairly annoying. They vacillate between a fingertip touch and an abrupt grip and torque which creates massive tissue guarding. "Did that hurt?" My description of how to touch patients and communicate with them is based partially on my personal experiences.

I had surgery a few years ago to correct a problem created by the effects of polio. The surgery altered the position of the left foot in relationship to the leg and dramatically changed my posture in standing. The new foot position brought my knee out of thirty degrees of hyperextension, into neutral. It reduced my severe anterior pelvic tilt and shoulder girdle retraction. After surgery I looked great, but I could not walk. I could not initiate gait with the new alignment. I could not even shift my weight. Traditional exercises and gait training did not solve my problem.

With the help of a therapist certified in neurodevelopmental treatment, I learned to move in space. We both learned a great deal about the impact of therapy on the whole patient. For example, I spent a great part of my treatment session asking the therapist what she was doing: "Talk to me back there!" She quietly worked behind me, stimulating weight shifting, stepping, and gait. She had a gentle touch and yet I felt as if I were being pushed and pulled around. The smallest weight shift, when unexpected, frightened me. I guarded or held against it. I often felt agitated during therapy. We tried working in front of a mirror where we could see each other and I could see myself. However, emotionally I could not tolerate the image of an erect body. It did not match my body image. I could not accept and use unfamiliar movements with the unfamiliar mirror image.

My movements in space quickly improved. Nevertheless it took some time for my proprioceptive senses to catch up with the new movements. I would lean over to shut the car door, and I would fall out of the car. The length of my arm changed with the new alignment of my shoulders. I would try to put a cup of coffee on the kitchen table, but instead it would land on the floor. Furthermore, I lost my penmanship. I could not sign my name for well over two weeks. My creditors were up in arms!

Yet another interesting phenomenon took place. I could feel and initiate a better pattern in gait during therapy, but within a few hours, I could no longer use the pattern. I lost the feeling of the movement. I could no longer initiate the movement because I could not visualize it. I felt I did not yet own the movement.

I have learned to slow down and talk with my patients. I tell them what I am going to do and what they might expect to happen. I talk with all of my patients, whether they are adults or infants. I grade my handling according to the patients' emotional responses as well as how their bodies respond. I earn their trust and try not to abuse it. We share control over the session. We work as a team rather than struggle against each other. They agree to work hard and I agree to be a caring and gentle person. It appears to be a reasonable trade off.
It is sometimes hard to reason and trade off with young children. They, like the adults, are often afraid of new movement patterns. Occasionally, the children cry during therapy. They become angry and frustrated. They do not understand that my hands are there to help, rather than intrude. Sometimes I treat them in their parents' laps where they feel safe. This does not always work. I offer them toys that can be used in many different ways, so they can experience success rather than failure. I encourage children to be imaginative. I stimulate their ability to visualize movement: "Today you are the airplane and I am the cloud." I give them ample periods of time to move without my hands on them.

As we treat patients, we gather information. We analyze their responses to our handling input by observing their movement. The change in their ability to move may or may not be what we predicted, but it provides us with the opportunity to gather more information. We utilize trial and error to collect information. The sensory input we offer a patient undergoes continual modification during this ongoing assessment process. This is a spontaneous process. As we receive and interpret information about a patient's movement, we transmit sensori-motor data back to the patient and wait for a response. As the patient is responding, we are modifying the input from our hands. With an intimate knowledge of normal movement dynamics and a variety of handling possibilities, the process of treatment becomes a graceful, fluid interaction.

This chapter will describe several ways of modifying sensorimotor input to obtain predictable changes in the patient's motor repertoire. As you read the chapter, I encourage you to therapeutically touch and handle as many able-bodied people as possible. This is probably not the worst suggestion you have ever received. You will find that every individual body feels slightly different. Muscle tone varies from person to person. Each body's approach to movement has unique qualities. Each person's level of comfort with touching varies. You can learn a great deal by practicing handling on others, because you can take your time and receive feedback about your perceptions. Once you become comfortable with the many different ways of modifying sensory information, you will find yourself changing your pressure, speed, and hand placement naturally during your treatment sessions. Before you begin, a review of terminology is in order.

**Inhibition and Facilitation**

Inhibition is the process of intervention that reduces dysfunctional muscle tone. Setting specific techniques aside for the moment, inhibition reduces the intensity of spasticity, making greater range and variety of movement possible. Inhibition reduces the influence of fluctuating muscle tone, making the control of mid- or small-range movements possible. Inhibition is not used with hypotonicity.

On the other hand, facilitation is the process of intervention which uses the improved muscle tone in goal-directed activity. The patient is active, and the therapist is guiding the activity. Facilitation makes movement easier. The movement is guided by your hands. You can stop the movement in midstream (Figure 1). Any time your hands stop, the patient's movements will also stop.

Inhibition is used with facilitation. They are accomplished simultaneously, with the least amount of physical intrusion. As you use techniques that inhibit dysfunctional tone, the patient makes more efficient movement adaptations. This happens spontaneously because your patients are
actively involved in functional movement and automatic postural reactions while your hands treat them. The concept of inhibition and facilitation was first described by Berta and Dr. Karel Bobath, the pioneers in neurodevelopmental treatment.

**Key Points of Control**

The places where we make physical contact with the patient are referred to as key points of control (Bobath 1980). We can key-point with our hands and any other parts of our body (Figure 2). We can key-point with our whole hand or fingertips. We can use therapy equipment or any surface as a key point of control (Figure 3).
Key points of control near the source of the problem are referred to as proximal. Proximal can also mean close to the head, torso, or large joints. In any event, proximal key points allow the handler the option of taking control of the patient's body during difficult movements (Figure 4).

Key points of control away from the problem source are referred to as distal. Hand placement on the extremities or away from the torso is also considered distal. With distal key points of control, the therapist is less able to control the patient's whole body response (Figure 5). When hand placement is at a distance from the problem, the patient will perform the majority of the work. The ultimate goal during therapy is to provide the least amount of intervention, as far as possible from the problem.
Grading Your Input

When I treat a patient, I respond to what I see and feel. I concentrate on eliminating the "background noise" coming from my own body, and focus on synchronizing myself with the patient's body. I trust my hands and grade my touch.

Sustained Light Pressure

I always begin with light touch. Light, non-intrusive touch can be felt through the hair and surface of the skin. With light touch you will not be able to palpate muscle and joint.

By placing the whole hand gently, anywhere on the patient, in a nonintrusive way, the patient will relax under your touch. You will gain important information about how movement is initiated, how the patient is attempting to control posture against gravity for independent function, and how compensation is made for the limited movement repertoire. You can develop a sense of the subtle central nervous system problems, signs that one might not observe visually. Your hands follow the movement and gently intervene by resisting the abnormal responses, without taking away the patient's active control. You make the small adjustments necessary to allow the patient to continue to function. The goal is to create movement that is easier and more fluid rather than simply concentrating on achieving "normal" movement. As the patient engages, in functional movement, light touch guides rather than controls. The emphasis is on facilitation with subtle, non-intrusive inhibition.

Sustained Deep Pressure

When a patient is continually bound by the same nonfunctional movement patterns, a gradual increase in your pressure is appropriate. With deep pressure you can feel the muscles and as you add more pressure you can feel the joints.

When using firmer or deeper pressure, it is important to keep your hand shaped on the body. Grabbing the patient forcefully or quickly will stimulate muscle guarding. You can slowly
increase your pressure over a period of time, allowing the patient to make ongoing sensorimotor adjustments to the new information.

Graded pressure combined with movement can have an inhibitory effect on abnormal muscle tone. The movement may vary in its excursion, but the direction is linear rather than circular. Think about moving through the barrier rather than around it. NEVER FORCE your way through the spasticity. Move the body part to the end of the existing range. Maintain your pressure at the place where the movement is restricted. Wait until you feel the restriction soften and the range in movement increase. Follow the increase in range to the next area of restriction. Wait again for a softening of the spasticity. You can add small excursions of movement at the end range to dissipate the restriction.

Deep pressure will give you a different level of proprioceptive information. With deep pressure you receive and send information into the muscles, bones, and joints. When you add deep pressure to graded movement, patients feel the sensation of balanced muscle coactivation around a joint. They can respond above and below the contact point of your hands. As you gradually lighten your pressure, you give them their control back. Your lighter touch feels and follows their movements. Treatment resembles a rather graceful dance, with both partners sharing the lead. We lead, they respond; they lead, we respond.

Interruption Touch

Interruption touch can be used with patients who potentially have the movement available to them but cannot yet combine the components functionally. Your fingertips or whole hand lightly touch the patient, with your contact on and then off. Your interruption touch guides them, but the patient does not rely on it being there. The focus is on facilitation rather than inhibition. This can benefit patients who are close to establishing reliable postural reactions or those who can perform a functional skill with some motor cues.

Treatment with Movement-Slow Movement

Combining touch and movement keeps the patient dynamically active. By "movement" I mean a change in the patient's center of gravity (a weight shift), active reach, random movement, or involvement in a specific functional task.

The therapist can lead the movement, follow the patient's movement, or intermittently lead and intermittently follow. Slow movement with a light touch encourages maximum control on the part of the patient. Feel your own body work as you move in slow motion. Sustained coactivation around the joints is required for slow movement (Figure 6). Children with spastic diplegia have a tendency to move very quickly, lunging from one position to another. They use their own momentum and gravity to take them through a transition. In gait, they fall from one foot to the other. When you slow their movements, they initially lose control and collapse into your arms. They may need slow movement to help them improve their control in space.
Fast Movement

Increasing the speed of your facilitation can encourage balance reactions and protective responses. Swift movements can guide you and your patient through a transitional movement pattern that the patient would normally resist. Vary your speed according to the response of the patient and your functional goal.

Treatment with Compression and Traction

As we use touch and movement in our gravity-bound environment, we send messages to the musculoskeletal system. In fact, gravity is sending similar messages to the body in the form of compression and traction. When we stand upright, the weight-bearing joints, from the soles of the feet to the tip of the head, are compressed or pushed closer together. The non-weight-bearing limbs are tractioned by the force of gravity pulling the arm toward the ground. When any force is strong enough to create a separation in the surfaces of the joint, we refer to it as distraction. How strong is the force of gravity on the dangling arms? It is strong enough that most people look for a place to put their hands, a place to plug in some compression. We often stand with a hand lightly weight-bearing into a pocket, on a hip, against a wall, leaning on a table, or hands clasped together in midline. When your arms are tractioned by gravity, the muscles respond by becoming concentrically active around the joints. Over a long period of time your arms fatigue, and you search for mild compression and a warm place to rest.

In standing, the weight-bearing joints are significantly compressed. For example, people waiting in a long line can be seen shifting from one foot to another. Static weight-bearing is exhausting. People who are frequent air travelers know the fatigue of sitting in one small spot. Like everything else, the body thrives on balance—balance between stability and mobility, compression and traction.
The patient's motor response should be initiated in the head and neck and not the low back or hips. When you use this treatment approach in sitting (Figure 51) and standing (Figure 52), remember to keep your patient's upper body in front of the center of
Sequencing is used for in-hand manipulation as well. Place an object in your patient's palm and ask the patient to turn it over, without using the second hand. Observe the blending and sequencing that occur during these attempts (Figures 235-238) Simple and reciprocal patterns of movement used in a sequence, bimanually, allow your patient success with buttons and jacket zippers, along with computer keyboards.

![Figure 235](image1.png)  ![Figure 236](image2.png)

![Figure 237](image3.png)  ![Figure 238](image4.png)

Writing and drawing require a different set of sequential movements. We know the dynamic tripod provides an efficient grip for writing tools (Figure 239). However, the ability to transfer information from thought to paper has less to do with the method of prehension and more to do with the ability to combine and sequence digit and wrist movements.

![Figure 239](image5.png)

This is a blend of intrinsic and extrinsic muscle activity. Specifically, the flexion and extension movements of the digits produce the vertical excursion of the line. Lateral wrist movements produce the horizontal excursion of the line. Once this interplay is established, it is further integrated into the fluid ability to draw and write.

When the patient cannot combine digit and wrist movements, whole-arm movements will be substituted. Unfortunately, generating movement from the shoulder for writing is not efficient. It will require significant voluntary effort to grade the excursion of the line as well as pressure of the tool on the paper. In fact, the patient often attempts to stabilize off the tool by leaning it onto the paper.

Support your patient's forearm on the writing surface to discourage whole arm movements. Gentle compression of the radius and ulna will provide additional stability. Allow the forearm to
slide on the surface in response to the horizontal writing movements. As the patient learns to move wrist and digits sequentially, the motor components for writing will improve and specific perceptual dysfunction will be easier to identify. Carryover can be managed with the patient supporting the forearm while writing. To avoid slippage, the paper is held in a clipboard with nonskid backing.

Complex Patterns of Movement

When we firmly stabilize an object in the hand and concurrently manipulate it, we are combining precision with power. Shoe tying is a good example of this type of pattern in a matured form (Figures 240-241). The pattern is consistently refined for work-related or diverse directed skills used throughout life.

![Figure 240](image)
![Figure 241](image)

I usually begin by introducing simple parts of this complex pattern. The toothpaste pump is a useful tool to introduce the combination of stability with mobility (Figure 242). The fingers and palm stabilize the base while the thumb and palm mobilize the pump. This may be the reason Elliot and Connolly (1984) describe this pattern as "palmar combinations." Removing a pen cap with one hand will stimulate this pattern as well (Figure 243). Both of these activities are component parts of scissor use (Figure 244).

![Figure 242](image)
![Figure 24](image)
The digits stabilize the object, the thumb is the mover, and the wrist alters the orientation of the hand to the paper. To further complicate this process, a second hand is used to hold the paper with the wrist altering the orientation of the paper in space. As these skills mature, they will become a complex, fluid interaction between two hands. When patients lack these complex movements, they learn to depend on the loop scissors.

I start my patient with the dressmaker’s approach to cutting. The paper is held flat and the orientation of the scissors is altered by sliding and rotating it on the working surface. When treating the young at heart, I use the squirt gun. It requires a palmar combination utilizing the index finger as the mover. However, aiming at a target encourages the eyes to visualize ahead of the hand, an important component of cutting.

Mastering these complex patterns of movement offers your patient hope for autonomy in a world filled with safety caps, complicated clasps, protective seals, and remote controls.

References
APPENDIX A

Current Trends in Upper-Extremity Splinting
Susan G. Hill, O.T.R.

Introduction
Orthoses for the hands-often referred to as splints-are devices fitted to the arm which position or immobilize the hand and wrist for the purpose of relieving pain, preventing or correcting deformities, and substituting for loss of motor power (Trombly 1983; Malick 1980). The general intent of all splint designs is to maximize hand function for the individual (Fess, Gettle, and Strickland 1981). In some cases splints can be used as an aid in evaluating a patient's rehabilitation potential prior to surgical intervention (Hunter et al. 1983).

The orthoses discussed in this paper represent current trends in upperextremity splinting. It is recommended that the reader refer to the references listed at the end of Appendix A for information on splints traditionally employed in the treatment of neurologically impaired patients.

Types of Splint
Three classifications of splints will be discussed in this paper. Static orthoses have no moving parts and serve to immobilize or "rest" the intended joints. Semidynamic orthoses also have no extrinsic moving parts but position joints so that the extremity can optimize its own available movement. The weight-bearing splint will be included in this group since it allows active transitional movement patterns. Dynamic orthoses employ moving parts (such as rubber bands, tension wires, springs, or elastic-like materials) to help the hand correct or compensate for muscle imbalance, increase range of motion, and improve joint alignment. The terms high and low profile, often used to describe dynamic splints, refer to the height of the traction device above the segment being mobilized (Hunter et al. 1983).

There are a number of commercially available "prefabricated" hand orthoses. However, these may not consistently fit well due to the number of anatomic and pathologic differences between patients (Cannon 1985; Johnstone 1978). For this reason the therapist is advised to design a specific splint pattern for each patient.

The materials used to construct hand orthotics will vary, depending on the individual needs of the patient and the therapist's preference of materials. Low-temperature thermoplastics (LTT) are commonly used to fabricate hand orthoses due to their relative low cost, ease in use, and lightweight and attractive appearance.
Hip Abduction

Gluteus Medius

The GLUTEUS MEDIUS is a primary hip abductor (Figure 318). This muscle originates from the external surface of the ilium. It inserts on the greater trochanter of the femur. When the trunk is stabilized in sidelying, this muscle lifts the femur laterally toward the pelvis (Figure 319).
Weakness in the GLUTEUS MEDIUS provides a poor base for reach in sitting. When we reach toward the sides, our legs stabilize onto the supporting surface through the action of hip abduction and extension. When hip abductors are weak, the patient will laterally flex on the weight-bearing side (Figure 320). This will serve to flex the upper torso into gravity. This pattern of movement interferes with controlled weight shifts and prevents righting and equilibrium reactions.

TENSOR FASCIA LATAE

This muscle originates from the anterior lip of the iliac crest and the anterior superior iliac spine (refer to Figure 313). It inserts into the iliotibial tract of the fascia LATAE. The TENSOR fascia LATAE flexes, internally rotates, and abducts the femur on the pelvis. This muscle may be shortened in patients that demonstrate more primitive hip control. In sitting and prone, the patient may stabilize into the surface with hip flexion, abduction, and external rotation (Figure 321). It is this position that allows shortening of this muscle.
The hip adductors consist of a group of five muscles. The Pectineus originates on the pubic surface of the pelvis and inserts on the pectineal line of the femur. This muscle adducts the femur, approximating the femur to the pubic portion of the pelvis. It can also assist in flexion of the hip joint due to its pelvic origin.