



*A Forum for
the exchange
of ideas
about the
most rapidly
growing
healthcare
discipline*

Adjunctive Therapy Devices: Restoring ROM Outside of the Clinic

By Evelyn J. Cohen, OTR/L

About the Author:

Evelyn Cohen, OTR/L has vast service-related experience with nationwide distributors of home therapy equipment and continues to practice hand therapy in the Chicago area.

One common goal of all healthcare practitioners is to permanently restore functional range of motion (ROM) in the safest, most time efficient and cost effective manner. In the vast majority of cases, it is not a

single technique that enables us to restore ROM, but a combination of applications that provide success. The current methods and products available to achieve this desired outcome seem endless. It is the responsibility of all therapists and healthcare providers to have an understanding of the science behind the various approaches, and when and why they should be used. Most importantly therapists must be knowledgeable of the benefits and detriments involved with the options available to our patients.

It is comforting to know that the clinical model of physical and occupational therapy is perhaps the most effective treatment option for regaining motion. Unfortunately, with a nationwide shortage of therapists and insurance companies dictating reimbursement and number of visits with a therapist, the traditional clinical model is rapidly changing. Because patients are spending less time under the supervision of a therapist and more time at home with independent exercise programs, how those patients utilize their time outside of the clinic is becoming more and more important in terms of recovery and cost. It is essential that they supplement their therapy goals with the most effective programs and products. ROM devices and orthoses at home that mimic what the therapist does by function and principle are the most beneficial kind.

When considering home rentals, patient compliance becomes the single most important factor. If patients are not comfortable and have no control over the device, success will be limited. The treatment sessions must be reasonable to compliment their normal lifestyle and they must see and feel timely results or they will not follow through with the given protocol. The more versatile the product, the more likely the patient will comply. The clinician is in a unique position to help determine which products will best suit their patient's individual needs.

ROM devices generally fall into two classifications, those that provide early motion and those that are utilized for the management of stiff joints and joint contractures. Physiological and clinical indications will help determine if a patient is an appropriate candidate for a particular device. The therapist then can facilitate the process further by contacting the most expert vendor. This role is very important as some companies offer identical products. Therapists should consider factors such as cost, service and reputation when making selections. The following is an overview of three ROM devices available for home rental. The purpose of this article is to help the reader differentiate between them, and to understand their theoretical basis and features. The more informed we are, the better decisions we will make for our patients.

Continuous Passive Motion

The literature is overwhelmingly supportive of the adverse effects of prolonged immobilization of synovial joints¹. Post surgically, intermittent motion enhances the biological healing response, and continuous motion does even more so². Continuous passive motion (CPM) is a treatment modality used to provide the benefits of early controlled motion following surgery or injury of the upper or lower extremity (see figure 1). After years of experimental and clinical research, Dr. Robert Salter concluded that CPM is well tolerated, has a significant stimulating effect on the healing of articular tissues, prevents adhesions and joint stiffness and influences regeneration of articular cartilage². Early continuous motion takes tissues through their normal ROM to ensure that they heal in an elongated fashion³. While CPM preserves ROM that is at risk of being lost, keep in mind that "motion never lost need never be regained"³.



L_
Figure 1

As the motion is being provided passively, in this instance by a machine, the patient is not causing an active muscle contraction. The diffusion of synovial fluid is occurring without the integrity of the repaired tissue being jeopardized. What this means physiologically is that the joint receives nutrition, venous flow increases and deterioration of cartilage is being prevented. What this means clinically is

that edema is decreased, pain is decreased, ROM is maintained and recovery is accelerated.

With short hospital stays and most procedures occurring on an outpatient basis, the majority of CPM usage is in the home. CPM devices are available for the shoulder, elbow, wrist, hand, knee, ankle, toe and jaw. Some typical indications for use include joint replacements, tendon and ligament repairs, burns, and bone, muscle and cartilage injuries. Once determined that a patient is an appropriate candidate (the joint is stable and free from infection) the most experienced vendor should be contacted. Most providers have trained clinicians knowledgeable of CPM usage and application, and a provider would confer with the physician as to the motions and ROM parameters he/she desires.

The clinician will go to the home with the most appropriate piece of equipment and set the patient up in ana-

tomical alignment.

The provider then will educate the patient and family on the equipment's purpose, benefits and usage. This is extremely important as the patients will many times be working with the CPM device independently, and must know how it works, how to advance their motion and who to call if

changes and questions arise. The line of communication is constantly open between the physician, patient and provider throughout the duration of the rental.

Since the motion is provided mechanically, there is no fatigability factor. Patients typically use CPM for eight hours per day post surgically, sometimes less than this if the indication for use is post immobilization. The patient secures the extremity into the device and runs it to a predetermined pain free limit. It is important that the patient always be in control, be able to stop the motion at any time and be able to advance the motion

when tolerated. CPM users are highly compliant being that they are pain free, in control and quickly regaining motion and function. As some joints move in multiple planes of motion, it is not uncommon to upgrade the protocol to provide different motions as the patient progresses. It is important to select a vendor who is accessible 24 hours a day, is responsible and is committed to being an active member of the patient's rehabilitation process.

Not all CPM devices are alike; newer models are constantly being manufactured making some older models obsolete. Make sure you are choosing a provider who will help you determine which device will best suit your patients' needs. Rentals are on a daily basis and cost varies from \$40 to \$75 a day, depending on the device and logistics. There is generally an initial soft-goods fee and a charge for the set up, inservice and follow through. Keep in mind that insurance companies have contracts with certain providers and prices are generally lower than what is customary. Typical duration of rental is from two to six weeks, depending upon the indication and patient progress.

Static Progressive Stretch Orthosis

A static progressive stretch (SPS) orthosis restores ROM in joint contractures by delivering the benefits of the biomechanical principle of stress relaxation⁴. Soft tissue (tendon, ligaments, muscles, joint capsules, skin and fascia) is viscoelastic in nature. If a viscoelastic material is stretched and then held at a constant length, the stress or force at that length gradually declines. This decline is called stress relaxation⁵. SPS is a series of incremental displacements held constant over prescribed periods of time. Given a chance to relax and absent of pain, connective tissue responds favorably. This desired response allows the tissue to become soft and pliable, paving the way to perma-

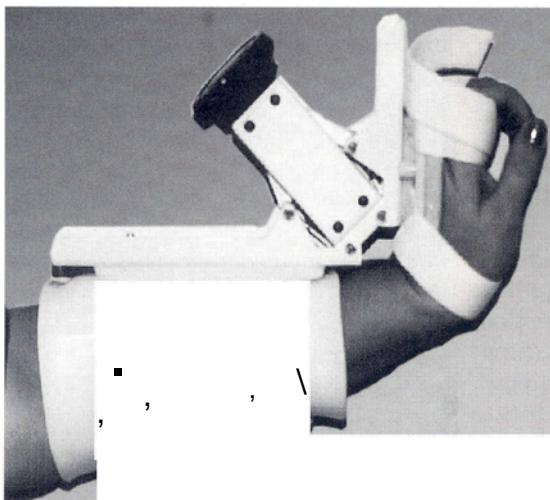


Figure 2

nent elongation or plastic deformation in the most time efficient manner. Once plastic deformation of tissues is obtained, it is maintained⁴.

Currently there is one unequaled SPS orthosis on the market available for rent for the management of the stiff elbow, wrist, knee and ankle (see figure2). The device arrives sized to each individual adult or child. Further customization is available as necessary for patients with unique challenges. The cuffs used help maximize surface contact area, avoiding point loading and discomfort. The design encompasses key features. The single planed device mechanism is engineered to allow for an infinite variety of positional displacements. As human physiology differs dramatically from individual to individual, this is a critical feature as it enables the patient to be the determinant of how much force to apply to achieve an optimal result. Patient directed therapy is crucial for patient tolerance and compliance. Every product has the ability to be used in both flexion and extension. This avoids costly rentals of a second device as many patients are compromised in both directions. It also helps reduce the risk of ROM loss in the opposite direction. Additional features include the fulcrum of applied force being displaced away from the center of rotation of the joint and the ability of the cuffs to translate in a controlled fashion away from the joint. These features

minutes, allowing the soft tissue to relax and resistance to decrease. The patient what conditions the stretching is then increases the ROM to the point of performed⁷. Research has shown that the tissue resistance, never to pain, and holds therapeutic protocols involving low load for five more minutes. This pattern is prolonged stretch are superior to high load repeated for a total treatment session of short duration stretch⁷. High force favors 30 minutes a day. The protocol progresses with the addition of 30 minute sessions per day for each additional week. The patient never exceeds three 30 minute sessions a day for each direction. Short treatment sessions eliminate the potential for damage to the articular cartilage and patients are able to carry on with the remainder of their home program. Patient directed therapy and short treatment sessions equate to high patient compliance.

Rentals are on a monthly basis and cost varies from \$175 to \$265 a month depending on the joint involved. There is an initial cuff charge. The clinician or local representative generally will fit the patient to the device and instruct them on the usage protocol, there is no fee for this service. The average total treatment time per direction of motion is approximately 65 hours, spanning a typical rental duration of approximately one to two months⁴.

Dynamic Splinting

Therapists who treat patients with joint stiffness and joint contractures have all experienced the frustration of having a patient achieve good ROM gains during one treatment session only

help to eliminate the risk of to return a couple days later having lost joint compression, as well those gains. Clinicians often utilize dynamic tension orthoses to help their patients maintain ROM between treatment sessions (see figure 3). Dynamic splints can be described as “devices that provide an external force to input stress on a body segment within an anatomical plane of movement”⁶.

The patient is easily able to apply the device by adjusting the angle to a comfortable position. Connective tissue responds to stresses it undergoes. It is a viscoelastic material, meaning after being elongated or stretched the joint to stressed it possesses the ability to either recover back to the original shape or handle to increase ROM in length (elastic) or deform and remodel to a new length (plastic). The relative proportion of elastic vs. plastic deformation

varies, depending upon how and under what conditions the stretching is performed⁷. Research has shown that the therapeutic protocols involving low load for five more minutes. This pattern is prolonged stretch are superior to high load short duration stretch⁷. High force favors an elastic response and can cause trauma and weakening to the tissue⁸. Dynamic tension devices are designed to provide the biomechanical principle of creep, a continual elongation of tissues in response to a constant tension applied over time.

Historically, therapists have fabricated custom dynamic tension splints, the process being quite labor intensive. Commercial devices available are well

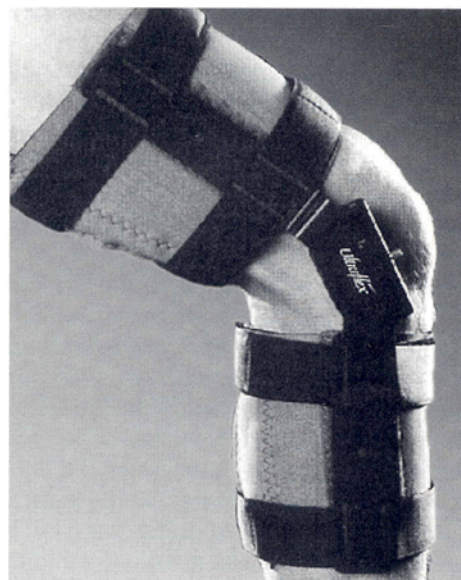


Figure 3

accepted, convenient and an effective means of delivering creep, with the lightweight, removable splints offering the patient a comfortable fit. Devices differ in design from manufacturer to manufacturer, and are available for stiff elbows, wrists, knees, and ankles. Local representative sare available to familiarize you with their highlights and features. Some indications of use can include fractures, arthroplastys, tendon and ligament repairs, CVA's, and burns.

Most are available for one direction of motion, either flexion or extension, though recent advancements now offer a limited market for devices that work in both directions. They are generally designed with separate struts and hinges on opposite sides of the joint joined by a soft cuff. The devices allow for full range of motion. They are prefabricated and arrive for the clinician or local representative to do the initial fitting, usually entailing simple cutting and contouring of the cuffs and educating the patient of the anatomical alignment. Some devices offer a lock out mechanism for ease in removal and application.

Once fitted, the tension is adjusted with a tool. The low load gradually takes the joint to higher ranges of motion as the tissue responds and elongates. The patient is instructed to slowly build up a tolerance for the device in terms of duration and tension. Initial use begins at a low tension setting worn during the day. After the patient easily tolerates wearing the device for a number of hours, the tension is then gradually increased. Manufacturers recommend that the patient utilize the device at night when they are most relaxed, this also

frees up time during the day to devote to their home program. The patient should be able to tolerate four to eight continuous hours during the day before attempting to wear it overnight and they should tolerate the therapy all night without pain before increasing the tension. Creep takes plae during the first six to eight hours of loading⁹. Manufacturers recommend at least eight to twelve hours of use per 24 hour period.

Some devices are for monthly rental, while others are purchase products only. As prices vary from vendor to vendor, rentals can range from approximately \$200 to \$300 per month, and purchase prices can range from \$1000 to \$1500. If renting, there may be an initial cuff charge and some companies charge a set up fee. If more than one direction is indicated, two devices may have to be ordered. Clinicians should search for products that offer both directions of motion or companies who will work with you by changing directions to previously purchased splints. Typical duration of usage can be from three to eight months.

Summary

With healthcare management shifting from the clinic to the home, ROM devices are efficient therapeutic tools to supplement and enhance a comprehensive rehabilitation program. The three ROM techniques highlighted in this publication are effective in providing early motion (CPM) and restoring ROM lost to soft tissue contractures (static progressive stretch orthoses and dynamic splinting). As clinicians play a key role in the decision making process, it is important they know the differences

between the available devices in terms of application and usage and also be aware of the significant variations in theoretical basis and principle. Overall rehabilitation costs can be kept to a minimum if all healthcare professionals are committed to restoring functional mobility in the most effective and time efficient manner. Utilizing ROM devices or orthoses at home help to meet that goal.

References

1. Akeson, W.H., Amiel, D., Abel, M.F., et al: Effects of Immobilization on Joints. Clin. Orthop. Rel. Res., 219,1987.
2. Salter, R.B.: The Biologic Concept of Continuous Passive Motion of Synovial Joints, The First 18 Years of Basic Research and Its Clinical Application. Clin. Ortho. Rel. Res., 242:12-25,1989.
3. Diehm, S.L.: The Power of CPM: Healing Through Motion. Continuing Care, 8,1989.
4. Bonutti, P.M., Windau, J.E., Ables, B.A., Miller, B.G.: Static Progressive Stretch to Reestablish Elbow Range of Motion, Clin. Ortho. 303 :128, 1994.
5. Taylor, D.C, Dalton, J.D., Seaber, A.V., ans Garrett, W.E.: Viscoelastic Properties of Muscle-Tendon Units, The Biomechanical Effects of Stretching. Am. J. Sports Med., 18:300,1990.
6. Richard, R., and Staley, M.: Dynamic Splinting - Basic Science and Modern Technology. Physical Therapy Forum, April, 1992.
7. Sapega, A.A.: Advances in the Non Surgical Treatment of Joint Contracture: A Biophysical Perspective. Postgraduate Advances in Sports Medicine, 1988.
8. Hepburn, G.R.: Case Studies: Contracture and Stiff Joint Management with Dynasplint. J. Orthop. Sports Phys. Ther., 8:498,1987.
9. Eihorn, A.R., Sawyer, M.: The Problem Knee: Soft Tissue Consideration. In: Engle, R.P. ed. Knee Ligament Rehabilitation. New York: Churchill Livingston, 1991: 197-21