SHORT SUMMARIES OF THE LECTURES INVITED TO THE THIRD CONGRESS OF BOSNIA AND HERZEGOVINA PHYSIATRISTS
Tuzla, October 27-30, 2010

ADDRESSING THE NEED FOR PROSTHETIC EDUCATION FOR MEMBERS OF THE MULTIDISCIPLINARY REHABILITATION TEAM

Hector Casanova, CP/L, BSc.P&O

The Center for International Rehabilitation (CIR) is a not-for-profit organization that develops technologies and programs to help people with disabilities worldwide reach their full potential. CIR programs have operated in collaboration with Northwestern University's Prosthetics and Orthotics Center, the Rehabilitation Institute of Chicago (RIC), and other international and national institutions.

A primary focus of CIR is its Internet-based Advanced Distributed Learning Network (IDEAnet), which delivers professional training and support. A special focus of IDEAnet is the provision of technical and educational assistance to professionals who provide services to war-wounded individuals and amputees. The CIR's blended learning programs delivered through the IDEAnet platform rely on the development of culturally-appropriate content and a tailored mix of educational tools including texts, electronic interactive media, and on-site workshops to serve the largest possible audience in the most cost-effective manner. Programmatic elements include: prosthetics and orthotics training, store-and-forward teleconsultations, and the distribution of innovative medical and rehabilitative care technologies. To date, CIR-developed courses have been offered at over 40 rehabilitation centers in 7 countries, including prosthetic and orthotic clinics in the Bosnia and Herzegovina, Serbia, and Slovenia.

In addition, the CIR and the University Clinical Center (UKC) recently worked in collaboration to develop training materials for Iraqi rehabilitation professionals. Additional assistance for this effort was provided by professionals at the Northwestern University Department of Physical Therapy and the School of Public Health at the University of Illinois at Chicago (UIC). In all, 100 Iraqi medical professionals received comprehensive practical and theoretical instruction in Bosnia and Herzegovina. The CIR and the UKC are now planning to implement a distance-learning program that will build upon the existing network in the Balkan region to provide short-term upgrade training courses to physical medicine specialists (physiatrists) and physical therapists in the Balkans.

It is expected that expanding the CIR's training to include key-members of the rehabilitation team will result in improved communication, collaboration, and understanding among rehabilitation professionals. Ultimately this will result in the improved provision of services to landmine survivors and other individuals with physical disabilities from the region. By increasing the quality and availability of professional education, it will be possible to ensure lifelong access to rehabilitation services. This is best achieved by providing continuing professional education in partnership with rehabilitation clinics and conducting workshops to deliver services to patients in Bosnia and Herzegovina.

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COST EFFECTIVE PROSTHETIC TECHNOLOGIES

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Since the end of the Second World War, the United States (US) and European nations have invested heavily in the development, refinement, and application of a range of new rehabilitation technologies to improve the lives of persons with disabilities (1). In particular, the field of prosthetics has been revolutionized by the introduction of new materials and electromyography-based control systems, among other innovations. The majority of this technology has now found its way into areas with limited resources on virtually every continent (2).

Furthermore, as post-World War II economies and industrial infrastructures have matured, much of this technology has been adapted to suit the needs of individuals abroad, resulting in a range of technological modifications that have improved product design, therapeutic efficiency, and cost. These modifications have given rise to improved design and efficacy of many prosthetic systems. Alternatively, constraints of resources and technical expertise, and a lack of availability of appropriate materials have resulted in innovative and cost-effective design and testing approaches for rehabilitation technologies.

In many regions a particular urgency arises because of the increasing cost of rehabilitation technologies and services within a nation' healthcare system. The US Department of Defense (DoD), for example, has invested in several new large-scale prosthetic initiatives to improve the performance of the upper-extremity prosthesis due to the large number of upper-extremity amputations that have arisen as a result of combat (3). While these military-sponsored advancements have been both enormously innovative and technically advanced, the net results to date have included a sharp escalation in the cost of these new prosthetic systems and a corresponding shrinkage in the economic feasibility of their use in the delivery of everyday rehabilitation services. At a projected minimum of $100,000 US dollars per prosthetic device, fewer and fewer healthcare systems will be able to fund and maintain such systems going forward.

An instructive example of this dilemma is the availability of high-tech lower-limb prostheses (e.g., the C-Leg® from Otto Bock) the costs of which are typically significantly higher than that of other available prosthetic systems ($30,000 versus $6,000). Although these new lower-extremity prostheses are likely to enhance amputee performance considerably, by virtue of their reduced weight and more accurate simulation of natural limb mechanical impedance, it is not yet clear (nor has it been demonstrated) if these potential advantages justify the substantial difference in cost.

One of the main purposes of the US Rehabilitation Act of 1973 (Act) is to empower individuals with disabilities to maximize employment, economic self-sufficiency, independence, inclusion, and integration into society through mechanisms such as rehabilitation research and training. Research grants may be used to develop new knowledge and methods in the rehabilitation of individuals with disabilities in the United States and abroad.

Potential Solutions

Through the Rehabilitation Engineering Research Center (RERC) on Improved Technology Access for Landmine Survivors, the Center for International Rehabilitation (CIR) developed appropriate prosthetic technologies and training materials to foster the building of the local capacity necessary in underserved areas to provide continuing support to amputees with limited or no access to healthcare. These efforts were aimed at yielding universal benefits through training modules and innovative prosthetic technologies. Although these products were designed for rugged environments and can be administered and fabricated more efficiently, well-designed systems that facilitate the provision of cost-effective rehabilitation services have relevance wherever prosthetic services are needed.

These rehabilitation systems provide high-quality, cost-effective, and lightweight prostheses for persons with limited access to prosthetic care, whether due to funding restrictions, geography, or both. There are a number of existing prosthetic technologies, clinical facilities, and trained personnel available to meet the needs of lower-limb amputees, but gaining access may be difficult. In spite of the availability of resources, many amputees in the United States who would have a greater level of independence and would greatly benefit from using a prosthesis

do not receive one due to lack of funds or a lack of access to rehabilitative services. The provision of prostheses to amputees in the US who lack resources would increase their mobility and their ability to attain and maintain employment. This would allow these individuals to improve their social standing.

Prosthetic solutions that may address this unmet need include the following components:

- Vacuum-based Impression and Alignment System (patent pending)
- Monolimbs - including a novel design known as the X-Shaped Pylon, which is a dynamic and simple copolymer pylon design that allows movement in the transverse plane
- Shape&Rollä prosthetic foot - a foot that mimics the roll-over shape of the able-bodied ankle-foot complex during walking

The application of the techniques outlined in this presentation will serve as the critical first step in the dissemination of appropriate technologies in the Balkans. This approach will allow for the enhancement of rehabilitation services provided in the region by ensuring the delivery of resources and knowledge needed to create effective and low-cost prosthetic technologies. In addition, the presentation will serve as the critical foundation for a long-term strategy that will serve to enhance the lives of the people with disabilities.

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POSTOPERATIVE MANAGEMENT OF RESIDUAL LIMBS FOLLOWING AMPUTATION

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Proper management of the residual limb (stump) after the amputation and before prosthetic fitting includes prevention of wound infection, immobilization of soft tissue to facilitate healing, provision of constant compression to control edema, pain and to promote shrinkage. It should prevent accidental trauma to the residual limb and be easy to reapply by the patient. To minimize postoperative complications and discomfort, many methods have been used. In this presentation, only two techniques, removable rigid dressing (RRD) and elastic stockinet (Compressogrip or Tubigrip), will be discussed. Both have been proven easy to learn and apply, and are cost-effective.

Whether to use RRD or elastic stockinet depends on the presence or absence of bony prominence. Basically, the RRD is preferred for knee disarticulation, transtibial amputation and Syme's amputation. Elastic stockinet can be used for all other levels of major amputation.

Elastic stockinet

Elastic stockinet is commercially available in rolls and in various sizes. It can be stretched easily onto the residual limbs (stumps) or edematous limbs of patients with venous insufficiency. One can achieve a desirable pressure by applying as many layers as needed or as one can tolerate. The stockinet of various lengths and sizes are used to create a gradient pressure with more compression distally than proximally in order to assure progressive shrinkage from distal to proximal area. However, one needs to carefully monitor distal circulation and skin response to the compression, especially over bony prominences.

Removable Rigid Dressing (RRD)

In the 1960s, the experience of immediate post-surgical fitting (IPSF) by Berlement et al, in France and Weiss in Poland, and Burgess in the United States led to major advances in the rehabilitation of amputees. However, the need for frequent removal and reapplication of the IPSF by trained clinicians limited its wide acceptance. In later study, the IPSF with immediate weight bearing was noted to interfere with wound healing. The approach of using non-removable rigid dress without attaching a pylon-foot unit and delay weight bearing by two weeks was used as an early post-surgical fitting (EPSF).

In 1977, the RRD for transtibial amputation evolved from the EPSF approach with a modification of its casting procedure method and suspension method. What made the RRD an effective procedure include: 1) using a non-expandable plaster cast to prevent edema from developing, 2) using a supracondylar suspension system to make the knee-high cast removable, 3) the ability to inspect the wound condition and to add stump socks for progressive shrinkage, 5) allowing immobilization of soft tissue to promote wound healing and control residual limb pain, 6) prevention of accidental trauma, 7) using of cotton spacer during casting procedure for pressure relief over bony areas, and, 8) allowing controlled graded weight bearing and frequent post-weight-bearing wound inspection. Because of complete elimination of skin breakdown, fast stump shrinkage, rehabilitation of the transtibial amputee has been improved since the introduction of RRD in 1977.

References

1. Mooney V, Harvey IP Jr et al. Comparison of postoperative stump management: plaster vs. soft dressings. J Bone Joint Surg 1971;53A:241-249.

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2. Berlement M, Weber R, Willet JP. Ten years of experience with immediate application of prosthetic devices toamputees of the lower extremities on the operating table. Prosthet Orthot Int 1969;3(8).
3. Burgess EM, Romano RL, Zettl JH. The management of lower extremity amputations. Technical Report TR1O-6.Washington,
4. DC: Prosthetic and Sensory Aids Service, Departments of Medicine and Surgery, Veterans Administration, 1969.
5. Wu Y, Flanigan DP. Rehabilitation of the lower-extremity amputee with emphasis on a removable below-knee rigid dressing. In: Bergan JJ, Yao ST, eds. Gangrene and severe ischemia of the lower extremities. New York: Grune and Stratton, 1978:435-453.
6. Wu Y, Keagy RD, et al. An innovative removable rigid dressing technique for below-the-knee amputation. J Bone Joint Surg 1979;61A:724-729.
7. Wu Y,Krick HJ. Removable rigid dressing for below-knee amputees. Clin Prosthet Orthot 1987;11:33-44.
8. Mueller MJ. Comparison of removable rigid dressing and elastic bandages in pre-prosthetic management of patients with below-knee amputations. Phys Ther 1982; 62: 1438-1441 .
9. Taylor L, Cavenett S, Stepien JM, Crotty M (2008). Removable rigid dressings: A retrospective case-note audit to determine the validity of post-amputation application. Prosthetics and Orthotics International, 32 (2): 223-230.

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TREATING X-RAYS OR PATIENTS? REESTABLISHING BALANCE

José Miguel Gómez. MD, LO

For decades, the conservative management of scoliosis has focused around the patients' x-rays. Clinicians are able to see a still shot of each patient's spine and assess the location and degree of each deviant curve. However, as the industry has focused on the x-ray and the information it contains, they may have overlooked some of its limitations and over estimated its relative worth.

The modern era of conservative management of scoliosis began with the development of the Boston Brace at The Boston Children's Hospital in the early 70s. At the time of its development, braces were plastic girdles molded over individual patient casts. One of the developers of the new system, William Miller CPO, reasoned that when you purchase new shoes, a reasonable fit is obtained without individual castings. Rather, your feet are measured and you are fit with an existing module.

This was the beginning of the use of symmetrical standardized models that could be modified to fit most patients. In the absence of an individual casts, steps were needed to ensure that modules were adequately modified to address the needs of each patient. Evaluation of patient x-rays became an important component of such customizing. Clinicians could visualize the location of individual vertebrae and use the information to determine where corrective forces should be applied. Customized pads could then be applied to the inside of the generic module, applying the desired pressures to the spine. This x-ray based "blue printing" has become an integral part of modern scoliosis bracing.

The radiological signs gained from patient x-rays are certainly invaluable. The size and severity of each curve, the amount of rotation in the spine, and the degree to which the head and pelvis are aligned can be observed. In addition, aspects of each x-ray help treating physicians determine the skeletal maturity of each patient, influencing how long the brace will need to be utilized.

In fact, so much information can be derived from a good x-ray, that a competent central fabrication facility can produce a reasonable brace with selected anthropometric measurements and appropriate radiographs, without ever actually seeing the patient.

Unfortunately, this has created the risky mindset, that by supplying accurate measurements and a copy of an x-ray, an orthotist is providing clinical care. Such a position is certainly a disservice to the patients who are being treated.

As valuable as x-rays are, they only represent the patient's alignment at a given instant in time. While certain elements undoubtedly remain constant, others are prone to change. For example, a well intentioned radiology technician who is seeing a scoliosis patient with an extreme de-compensation to one side will likely encourage the patient to "stand up straight" or "straighten up" to get the best picture for the referring physician. Should the patient accommodate the request and actively "straighten up," that x-ray is hardly representative of the patient's day to day balance or the forces that are acting to further deform the spine. What's more, an orthosis built to these inaccuracies may or may not provide adequate correction.

In the pursuit of taking advantage of every technology that might improve the efficiencies with which patients are treated, clinicians should not loose sight of their role in the process. Their obligation is to treat the patient, not the x-ray. To do so requires careful evaluation of several clinical signs prior to any examination of an x-ray, and assimilating the findings into the treatment plans.

One of the first clinical signs to observe is the balance of the patient. Simply put, where is the patient's head in relationship to her pelvis? Does it deviate to one side or another? Is it relatively anterior or posterior? Such

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findings can and should be measured and monitored. They can often be corroborated by x-ray findings, however, the clinical evaluation, with the patient standing before the practitioner is the more reliable assessment.

The relative symmetry of the patient should also be looked at. Is the pelvis level, or is there a leg length discrepancy? When the patient assumes a typical standing posture, is there any obliquity to the pelvis? Is there a pronounced rib hump or scapula to indicate rotation? Are the shoulders level, or is one raise higher than the other? Once again, accurate real time assessment is more reliable than the snapshot offered by x-rays.

How flexible is the patient? Without a side bending x-ray, there is no radiological answer to this question. When such an x-ray is available, it provides an answer without specifying the question 'is the displayed flexibility active or passive?' However, clinical manipulation can inform the clinician of the patient's active and passive flexibility in both the sagittal and frontal planes. Such information is vital in gauging the effectiveness of your intervention.

It is not until such clinical evaluations are performed and their results considered that a truly comprehensive treatment plan can be developed.

Once the plan has been developed and initiated with the fitting of an orthosis, the role of the clinician continues. Many elements of a successful intervention can be reasonably assessed prior to the evaluation of the in brace x-ray. Both symmetry and balance can be observed in the fitting room. Clinical manipulation can provide an indication as to the degree to which the orthosis has provided the maximal correction for a given patient. While these various elements can and should be radiological confirmed, they can be monitored well before the x-ray is taken.

Optimal patient care requires the use of every clinical tool available. While technological advancements and central fabrication are both beneficial and efficient, the importance of skilled observation, clinical evaluation and individual consideration should never be overlooked.

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PROSTHETICS PRESCRIPTION PRINCIPLES

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Writing a prescription for a prosthetic device is only a small step towards the physical rehabilitation to improve the patient's function. To appreciate this process, one must have a clear understanding of the roles of the various individuals involved and the goals established for each one of those individuals. In the ideal setting the patient should be evaluated and treated by a multidisciplinary team. The team approach has been used for decades, both in the rehabilitation field and in the practice of prosthetics.

The overall process of formulating a prescription involves basically three steps. The first step includes the evaluation of the patient to identify the underlying condition and to establish a prognosis for future expectations. Step 2 involves actually writing the treatment plan and prescription for the prosthesis, as well as the physical therapy required. Education of the patient, and each member of the team also occur during this phase. Step 3 includes the follow-up procedures to assess the functional outcomes, such as mobility, self-care, and reintegration back into the community.

Prescriptions for prostheses should also include several specific details in order to ensure that the prosthetist has enough information. First, the age and activity level of the patient; activity levels are graded from 0 for non-ambulatory to 4 for very active patients. The design of the socket for weight bearing is the next priority, followed by the type of suspension, and foot and knee functions desired. The prescription should also specify if an endoskeletal or exoskeletal design is needed, and if the prosthesis should be heavy duty or a lightweight design.

The responsibility of writing a prosthetic prescription falls upon the physician, but the evaluation process, establishing prosthetic goals, and fitting the appropriate prosthetic device requires the input from other members of the team. Follow-up and long-term monitoring of the patient and the use of the prosthesis is essential to prevent complications and to ensure the best possible outcome.

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ADVANCES IN UPPER LIMB REHABILITATION IN STROKE

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Recovery of upper limb extremity (UE) remains a main challenge in stroke rehabilitation.

Recovery prognosis depends on the association of shoulder pain and sensory deficits but the main predictor is the severity of the initial deficit and the existence of at least some distal movement at the end of the first month. His has already been stated by Gowers almost 150 years ago who stated : "It is usually necessary to wait for a diminution in the palsy before an opinion can be formed. The parts in which there is some return of movement before the end of a month will probably recover useful power. Paralysis that is complete at the end of three months will probably remain considerable in degree for the rest of life".

In clinical practice prognosis can usually be made by the end of the third month of evolution. Depending on the existence of arm movements, and of wrist and finger extension, the decision will be made either to implement intensive upper limb training strategies or to focus on the prevention of orthopaedic complications and rely for independent daily activities on relateralisation and the development of mono-manual skills of the unaffected arm.

UE motricity may be limited by spasticity, weakness or lack of motor coordination.

Treatment of upper limb spasticity has greatly benefited from the development of botulinum toxin treatment. Indications fall into three main groups:

- Treatment of spasticity in shoulder and arm muscles, with the objective of improving comfort and reducing shoulder pain
- Treatment with high doses of toxin of arm, wrist and finger flexors in order to improve comfort and facilitate hand hygiene
- Treatment with low doses of toxin of finger flexors and thenarian muscles in order to improve hand function

Treatment of spasticity in shoulder muscles is difficult, and the relation between spasticity and shoulder pain is complex. Most frequently spasticity is predominant on shoulder adductors and internal rotators. Pectoralis major is easily reached. Injection of internal rotators especially subscapularis is more difficult. The arm is placed in maximal internal rotation and extension, and the needle is inserted at the medial edge of the scapula parallel to the anterior side. Alternative injection routes have been described.

Spasticity in the hemiplegic arm and forearm usually involve elbow flexors, forearm pronators, wrist and finger flexors and intrinsic hand muscles. Botulinum toxin injections have been shown to reduce muscle tone and increase passive range of motion. The ashworth scale is usually reduced by an average of one point. The increase in the range of motion is on average around 20° for shoulder abduction and arm extension and 30° for wrist extension. Reduction of pain is also observed. The doses required for the treatment of major upper limb spasticity usually range form 200 to 300 botox units (1000 to 1500 Dysport units). Active range of movement improvement and functional improvement are less often observed. There occurrence depends crucially on the existence of antagonist active movement.

In some patients with good recovery, small dose injection of selective muscles may be efficient in flexor digitorum, flexor pollicis longuis and the hand muscles.

Treatment of hand weakness relies on active movement. Recent research has both led to better understanding of the neural reorganisation underlying motor recovery and produce evidence that intensive treatment is more efficient. Although there remains a gap in our knowledge of how the therapeutic effects of movement are exactly mediated, we are getting closer to understanding how targeted rehabilitation strategies interfere with plasticity.

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Functional MRI and electrophysiology (MEG and motor evoked potentials) are valuable tools in these fields. The present knowledge on somatosensory cortex plasticity shows, both in monkeys and humans that reorganisation occurs after stroke and that non use induces inactivation of the corresponding motor cortex. Recent fMRI data show that the networks involved in active movement, passive movement and movement observation are very similar. In parallel to these studies, clinical studies have shown that intensive training of the affected arm could increase motor recovery. A number of different techniques have been studied.

Constraint induced therapy associates intensive training of the affected arm and restriction of unaffected arm movement. Both could contribute to the reorganisation of the motor cortex by decreasing non-use inactivation and controlateral inhibition. Robot assisted training provides intensive repetition of simple arm movements. It allows passive, assisted active, active and resisted movement and could be of use in patients who are too weak to perform independent movements. Mirror movements, movement observation, and mental practice, have been shown to a lesser extent to have effects. This could be due to the fact that these tasks evoke activities in networks which are very similar to those involved in active movement and thi could be a way to retrain patients with major deficits. A recent review summarizes the evidence for all of these rehabilitation strategies. At present, there is still a lack of evidence that any specific strategy significantly improves hand function. Because the function of the affected upper limb remains often severely impaired, evaluation should be focused on bimanual tasks. Indeed improvement of monomanual tasks such as peg tests may be of little clinical relevance since such tasks will be performed in every day life by the unaffected limb.

In many cases, independent performance of daily life activities can be achieved despite significant upper limb function impairment. Training of mono-manual tasks with the unaffected limb is a key issue in stroke rehabilitation. A variety of aids and techniques will also help and perform such tasks.

References

1. P Langhorne, F Coupar, A Pollock Motor recovery after stroke : a systematic review. The Lancet neurology, 2009 8 741-754.
2. JH Cauraugh, N Lodha, SK Naik, JJ Summers Bilateral movement training : a structured review and meta-analysis. Human movement science 2010; 29: 853-870.
3. Yelnik A, Colle F, Bonan I. Treatment of shoulder pain in spastic hemiplegia by reducing spasticity of the subscapular muscle. A randomized, double blind, placebo controlled study of botulinum toxin. J Neurol Neurosurg Psychiatry, 2007; 78: 845-848.