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New Bracing – the Challenge and the Payoff:

To enable the ultimate goal of efficient walking requires much more than making a brace for a limb. It requires a greater understanding of the Individual in need. Efficient walking must be planned. There are a plethora of issues that must first be recognized before they can be solved. The bracing of the future will no longer just be molded materials around a limb; it will improve the alignment of the limb better than ever before, it will offer more functional possibilities, the movement strategy and the brace will be designed to work together symbiotically for the person as a Solution based program, with efficient outcomes planned. In order to enable a person to reach new potentials, even potentials once thought unobtainable, an involved commitment by all involved is necessary.

We have all seen amputees walk and run with ease and grace. Why can't a brace user do that? Even people with very low-level paralysis involvement rarely can emulate what many amputees can do functionally. Why is that? The Solution development is more complex. Utilizing new clinical theories in lower-limb orthotics that are evidence based can enable a brace user to stand, walk, and even run more efficiently. New bracing solutions are now making it possible to close the gap between prosthetic's and orthotic's capabilities. These new bracing solutions are based on new or expanded concepts, designs, and advanced materials.

Chal-lenge vt. 1) to invite somebody (or oneself) to participate in a (activity), fight, contest, or competition, 2) to dare somebody to do something, 3) to stimulate somebody by making demands on the intellect (Neuro stimulation)

n 1) to invite somebody (or oneself) to participate in a (activity) fight, contest, or competition, 2) a test of somebody's abilities or a situation that tests somebody's abilities in a stimulating way

The word **en-a-ble** vt 1) to provide somebody with the resources, authority, or opportunity to do something, 2) to make something possible or feasible
from Encarta World English Dictionary copyright 1999

Is the challenge worth it?

The new bracing solutions only *enable an* individual with a greater potential than they had before; what the person does with it is critical to the outcome. The people who have faced the challenge and overcame the obstacles are living a better life. Outcomes once thought unobtainable are now being realized. Activities thought lost forever are being reclaimed. A majority of the users can do more and use less energy and experience a reduction in fatigue. Many have a reduction in pain and many people feel stronger. Balance and security are improved with better mechanics and patterning; standing and walking are more efficient. Majority of individuals have downgraded the need for other assistive devices (canes, crutches) and majority of users are more active. Some people have regained muscles or muscle strength caused by disuse atrophy syndrome(s). Psychological benefits for users and members of their support systems have been witnessed.

The challenges will be unique and somewhat different for each individual but some common themes are: [one brace user's (M.E.) personal experiences in brackets]

1. Understanding how this new technology works, how it could benefit the individual, and confronting myths and old paradigms about bracing: e.g., that hyper extension of the knee can only be controlled with posterior support or that a weak/absent quadriceps can only be supported or treated with a KAFO. [overcoming skepticism about claims that, initially, seemed "too good to be true".
2. Unlearning old, inefficient patterns of walking. [old patterns felt "normal" to me; was, and still is, hard to self-monitor and self-correct faults in gait pattern]
3. Learning to TRUST that the device will stably hold the person upright during single leg stance on the weak leg. [this has been very, very difficult for me].
4. Hours of repetition of new body positioning and new gait pattern – practice, practice [making the time to practice the exercises until each move felt natural and was automatic]
5. Believing that you are worth the investment!!
6. [Being able to *look* at myself in mirror as I walked]
7. [Confronting the reality that knowing how gait should be intellectually doesn't translate into being able to **do it!!!**]
8. [Being patient with myself – I walked the old way for 54 years; it was unrealistic to expect to perfect the new way in only a few months]

The payoffs:

1. improved safety and stability which results in decreased falls/injuries. [noticeable excellent knee support—no sensation that knee is going to buckle]
2. improved walking efficiency & decreased energy output [I am able to walk about 4 times further 'hands free' than I was with a conventional AFO, can walk faster, and have decreased trunk lean with each step on the weak leg by at least 80%; therefore a much less obvious limp]
3. no metal and usually no straps, buckles or Velcro [avoided having to start using a locked knee KAFO and all its disadvantages and do it with only an AFO!!]
4. more fluid walking pattern with nearly equal stride length & stance time.
5. can be worn/used for many activities – in water, for cycling or, for running. [can go up some stairs one foot after another, instead of only one step at a time]
6. Increased confidence and self esteem [Incentive to begin weight loss program **and** be successful losing 50 pounds!]

Efficiency

- Stand, Walk, Run
- Point A to Point B

Conventional Orthotic Systems

- History

Mechanical Science

- Quantified & measured
- Governed by Law of Physics

What an Orthosis should do!

- Corrective Forces in 3 dimensions
- Improve & Maximize alignment
- Compensate for structural deficits
- Compensate for functional deficits
- Enable

Why we should quantify Outcomes

- Drives innovation
- Improves outcomes
- Allows comparison to other designs

Body Compensations

- Cost of Walking Speed

The Challenge – is it worth it?

- Commitment
- Training
- Outcome

Comparisons:

- Bare foot --% of normal = 19.8 % of normal
- Graphite Solid Ankle -- % of normal = 30 % of normal
- Dynamic Graphite Composite -- % of normal = 67.9% of normal

Video Comparisons:

Cost of Energy

- Compensations
- Braking & Accelerating

Outcome Measurement

Orthotic Design

- Functional
- Security Issues
- Support Systems

Solutions

- Floor reaction Designs
- Structural Control
- Functional Outcomes
- Security & Efficiency

Stance & Swing Phase

- Conventional – primarily swing phase
- Stance is most important

Gravity: Friend or Foe?

Balance & Efficiency

Walking Better