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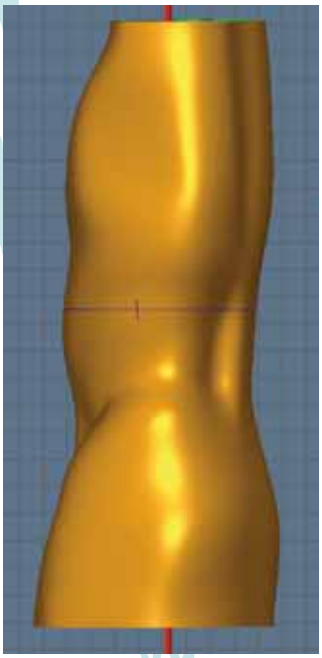
DYNAMIC ORTHOTICS *and* PROSTHETICS

Scoliosis Management:
In Search of a Better Tool



Miguel Gomez, an emergency room physician in his native nation of Colombia, SA and licensed orthotist in the United States, has spent the last two decades refining his approach to the orthotic management of the spine. Along the way he has developed distinct methods of optimizing the treatment effectiveness provided to each and every case. One of his most recent additions is his expanded use of CAD-CAM technology to produce the complex models that ultimately govern the corrective shapes of each orthosis.

Standard production of custom-made spinal orthoses is both labor and time intensive. Clinicians often take plaster casting impressions of each patient's torso. These are then filled with plaster of paris to create a replica of each patient. The clinician then rectifies each mold by hand to obtain the desired shape, which will dictate the ultimate size, shape and contour of the brace.

For years, Dr Gomez devoted considerable time and energy to refining the processes of both casting and model rectification. His constant goal throughout these pursuits was to provide the best support possible to the spine. While his methods were effective, they were time consuming, time that could be spent with the patients themselves.

Therefore, approximately two years prior to his arrival to Dynamic Orthotics and Prosthetics in Houston Texas, Dr. Gomez began Continues Page 2

If your organization would be interested in an in-service on prosthetics and/or orthotic care, please contact company President, Tom DiBello at (713) 747-4171.

Treating X-rays or Patients? Reestablishing Balance

For decades, the conservative management of scoliosis has focused around the patient x-ray. Clinicians are able to see a still shot of each patient's spine and assess the location and magnitude of each curve. However, as the industry has focused on the x-ray and the wealth of 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 Boston Massachusetts 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 the relatively minimal variations observed in the body types and sizing of his patients might allow for the provision of adequate bracing by customizing one of a few predetermined generic modules, obviating the need for individual patient castings. Continues Page 3

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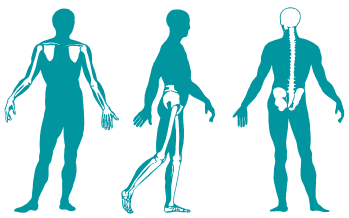

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Scoliosis Management (continued)

to experiment with CAD-CAM technology. Such computer assisted fabrication techniques have long been successfully utilized in the provision of certain types of prosthetic sockets and post-fracture body jackets which are fairly generic in shape. However, the intimacy and accuracy demanded in the treatment of the spine deformities has historically prevented its use in these populations.

Developing techniques that have astounded the developers of the CAD-CAM program itself, Dr Gomez has since shown that the same quality of scoliosis bracing obtained by his traditional methods can be produced by computer-assisted fabrication when the mouse and laptop are in the right hands.

Prior to his CAD-CAM innovations, Dr Gomez spent the majority of his patient evaluation sessions in a very messy and time consuming casting procedure that was awkward and uncomfortable for most patients. What's more, the resultant mold often had imperfections in spite of the experience and knowledge of the involved clinicians.

Now, the plaster bandage of an initial office visit has been replaced by a tape measure.

The process is still exacting. Over 30 measurements are taken in and around the patient's torso. Careful assessments are made of each patient's flexibility in multiple planes of motion. The stability and alignment of each patient are critically evaluated.

> …same quality of scoliosis bracing obtained by his traditional methods can be produced by computer-assisted fabrication

Once these data are collected, Dr. Gomez inputs them into a computer, abandoning the bench-top for the desk top. The anthropometric data are carefully applied to one of dozens of different computer templates created by Dr. Gomez. Each template is representative of different body types and scoliosis curve patterns and magnitudes. These are then adjusted according to the flexibility of the patient and the alignment of their spine and pelvis. Modifications and alterations are made through the movement of cursors and the flick of a mouse. The resultant shape can then be sent to a remote carver, which then produces a positive model of the shape defined on the screen.

> It is a tool, and as such its effectiveness is limited by the knowledge and skill sets of those using it.

The value of such advancements to the patients are enormous. The inherent short comings of obtaining accurate patient molds are by passed. Further, clinician time is now spent doing clinical evaluations rather than carving plaster molds. What's more, results are more consistent and reproducible. But perhaps the most significant advantage to the CAD-CAM system is the enhanced ability of the clinician to affect rotation of the torso and spine in the transverse, sagittal and coronal planes.

However, Dr. Gomez is quick to point out the limitations of the CAD-CAM technology and its role as merely one element of the "Gomez Spinal System." It is a tool, and as such its effectiveness is limited by the knowledge and skill sets of those using it. Yet in the right hands, and with appropriate principles applied, we can happily assert that Dr Gomez has found a better tool.

Meet Our Staff

Receptionist Valerie Martinez

Q: What do you enjoy most about working in the O&P community?
A: Working with the patients and having them become part of our family.
Q: If you could retire tomorrow, what would be the first thing you would do?
A: Escape with my husband somewhere quiet.
Q: Tell us about your family?
A: I have been married 33 years to a wonderful husband named Richard and have three daughters and 6 grandchildren.
Q: What is the best advice you've ever received?
A: Never say can't.

X-Rays (continued)

This was the beginning of the use of symmetrical standardized models that could be modified to fit most patients. In the absence of 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 radiologic 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 optical 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 decompensation 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.

…clinicians should not loose sight of their role in the process. Their obligation is to treat the patient, not the x-ray.

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 findings can and should be measured and monitored as they can affect the progression of spinal deformities. 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 their a leg length discrepancy? When the patient assumes a typical standing poster, is their any obliquity to the pelvis? Is there a pronounced rib hump or scapula to indicate rotation? Are the shoulders level, or is one raised higher than the other? Again, accurate clinical assessment is more reliable than the snapshot offered by the x-ray.

How flexible is the patient? Without a side bending x-ray, there is no radiologic 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 radiologically 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.

The Case for Spinal Bracing

Orthotic management of spinal conditions presents both options and challenges to today's clinicians…options in the wide variety of devices now in use, challenges in selecting the most appropriate one for each patient's specific needs.

Spinal bracing encompasses three primary objectives:

- Control of back pain by limiting motion and unloading discs, vertebrae and other spinal structures through abdominal compression.
- Temporary stabilization of weak and/or injured structures, as in spinal immobilization following back surgery, or protection for injured ligaments or muscles.
- Long-term protection, control or correction of a spinal deformity by application of corrective force systems. In children with scoliosis or other spinal deformities, such as hyperlordosis or hypokyphosis, the orthosis is employed to provide partial correction or prevent progression of the deformities during completion of growth and spine maturation.

Virtually all spinal orthoses achieve these objectives by three effects: (1) abdominal compression, (2) restricted trunk motion, and (3) providing corrective forces to effect modification or partial correction of a spinal deformity.

How effective are spinal braces at achieving these objectives? Investigators generally agree that a well-fitting orthosis offers effective control of gross spinal motion, but its ability to control intersegmental vertebral motion is not as well accepted.

A brace custom-fabricated to a positive model of the patient's anatomy offers the greatest opportunity for success in this regard. However, newer off-the-shelf appliances are becoming increasingly adaptable with many more customization features than older models and thus more potential for measurable results.

Spinal orthoses are broadly categorized as flexible, rigid, or semi-rigid. Flexible orthoses consist primarily of cloth belts and corsets. Thanks to innovative application of resilient plastics in the last decade, semi-rigid devices combine the strength and support of traditional rigid materials with the comfort and improved tolerance of fabrics.

Flexible Orthoses

Flexible belts and corsets are prescribed for relief of low back pain associated with degenerative disc disorders, trauma or postural fatigue and, in certain cases, to provide a measure of biomechanical stabilization. They are typically made of cotton, nylon or rayon fabric.

Corsets serve primarily to unweight spinal structures by increasing abdominal compression. Adding rigid inserts and/or vertical stays can effectively restrict motion, either by physical limitation or as a reminder to maintain proper posture. Sacroiliac belts and corsets are sometimes used for postpartum and post-traumatic stabilization of pelvic joints.

Most flexible spinal orthoses come pre-fabricated and are custom-fitted and modified to patients' specific requirements. While many health practitioners provide and fit these flexible devices, an experienced certified orthotist is, in general, the most qualified and best equipped for addressing the unique needs many patients present.

Semi-Rigid Orthoses

Semi-rigid systems combine a high percentage of the spinal control provided by a rigid brace with the tolerance-enhancing comfort of a flexible orthosis. A new type of semi-rigid design is exemplified by the OrthoLux soft orthosis. This device incorporates breathable spacer fabrics laminated between layers of foam with semi-rigid moldable panels sewn into anterior and posterior pockets.

Rigid Orthoses

The well-trained orthotist's skill and experience is of particular importance in the initial fitting of and progressive adjustments to rigid deformity braces and in providing custom-fabricated orthoses.

Prefabricated braces—Among the significant prefab braces:

- Flexion-extension control braces employ one or more three-point force systems to limit flexion and extension, and to a lesser degree, rotation and lateral bending. They also increase abdominal compression. Notable examples include the "chairback" LSO and Taylor TLSO, which may be prescribed for relief of low back pain and immobilization after back surgery.
- Flexion-extension-lateral control orthoses, as the name implies, provide motion restriction for flexion, extension and lateral movement but minimal rotation control. Examples include the Knight LSO and Knight-Taylor TLSO
- Anterior hyperextension (flexion control) TLSOs apply a three-point force system to restrict forward flexion in the thoraco-lumbar area. They may also be used to treat the hyperkyphosis common among patients with osteoporosis or to provide support after spinal fractures. Commonly used models include the Jewett and CASH braces.
- Thermoplastic modular TLSOs, such as the Boston Overlap Brace, are typically manufactured in standard sizes and different curvature contours. With proper fitting, these orthoses have proven effective for treating back injuries such as spondylolysthesis, as well as discogenic low back pain and various deformities.

Body Jackets

While properly fitted prefabricated systems can be used successfully in a variety of applications, the greatest degree of control is obtained with a custom-molded body jacket.

A body jacket constructed of high-temperature thermoplastic applies firm counter force to spinal motion is all planes (flexion-extension, lateral and rotation) and elevates abdominal pressures. Because a

Continues Page 5

Bracing (continued)

properly molded jacket achieves total contact, pressures are distributed over the widest possible area. Patient comfort and compliance may be augmented by the use of frontal closures for easier donning and doffing, lightweight plastics, multiple cutouts to accommodate individual patient's anatomy and improve air circulation, and modern fabrics to wick moisture away from the skin.

Unfortunately, not all patients who require the definitive support and/or correction of a rigid body jacket will tolerate one: Common geriatric complications--reduced muscle tone, skin conditions, and scar tissue–often render a rigid orthosis unusable. In the past, these patients typically have been given a soft dorsolumbar support. While effective in mild cases, this intervention is usually not sufficient to enable patients with advanced deformity to resume a reasonable level of daily activities.

Today, an increasingly common approach is a soft body jacket. This orthosis maintains the total body contact provided by its rigid cousin, dispersing the corrective force over as wide an area as possible. Also like the hard jacket, it is custom-molded to a model of the patient's torso, but in place of the rigid, heavy thermoplastic shell, the soft version is constructed of lightweight plastic and soft inner foam, which combine to make the jacket substantially more comfortable to wear, simpler to put to on and easier to tolerate for extended periods. The challenge is to incorporate the most rigid materials possible and still promote compliance.

The soft body jacket is applicable for geriatric patients requiring external support for long-term spinal problems: osteoporosis, compression fractures and deformities of other origins.

Scoliosis Braces

Management of adolescent idiopathic scoliosis with a spinal bracing regimen continues to spark debate within the medical community. Proponents note that while permanent improvement of scoliotic spinal curvature is uncommon as a sole result of bracing, this modality has been proven effective at preventing further progression of abnormal curves until the patient achieves skeletal maturity.

Options range from the time-honored, though sometimes compliance-challenged, Milwaukee Brace CTLSO to the less-conspicuous Boston Brace TLSO. Others have advocated the use of the nocturnal bracing, such as the Charleston Bending Brace and Providence Scoliosis System, which operate under the principle that providing a more-rigorous corrective force over shorter periods, i.e. at night, will achieve desired spinal curve change while giving the wearer more freedom and a stronger self-image. More recently, attention has focused on the use asymmetric modules to promote the lateral shifts necessary to align the head and neck over the center of the pelvis. This concept, combined with emphases on moment loading over 3-point force systems, and anterior over posterior opening, are embodied in the newly developed 'Gomez Orthotic Spine System.'

Ready to Help...

While several different braces discussed in this article may be applicable to a given patient's needs, regional and individual preferences often dictate prescription decisions. Our qualified orthotic practitioners are readily available to discuss your patients' requirements and assist you in choosing the most appropriate spinal orthosis for their specific requirements.

Call our office any time you require assistance.

Spinal Bracing Terms

A system of nomenclature has been devised to describe orthoses in terms of the joints they encompass and the desired control for those joints. In this system, spinal braces are described as sacroiliac (SIO), lumbosacral (LSO), thoracolumbosacral (TLSO), cervicothoracolumbosacral (CTLSO), cervical (CO) and cervicothoracic (CTO) orthoses. Control is generally described in terms of spinal flexion, extension, rotation, and/or lateral (bending).

While this terminology is becoming common, some traditional ways of naming and categorizing spinal systems remain in popular use. Orthoses may be classified:

- as to rigidity (i.e., flexible vs.semi–rigid vs. rigid)
- by the presenting diagnosis (e.g. scoliosis brace); or
- by details or materials used in fabrication (e.g. plastic body jacket).

The specific name of an orthosis may be an eponym (e.g., Knight brace), credit the city or institution in which it was developed (e.g. Boston Overlap Brace), or reflect some other pertinent detail of its construction or application. But because the same orthosis is often known by different names in different disciplines, specialties and geographic regions, the more complete the description when discussing or prescribing spinal braces, the less opportunity for confusion or error.

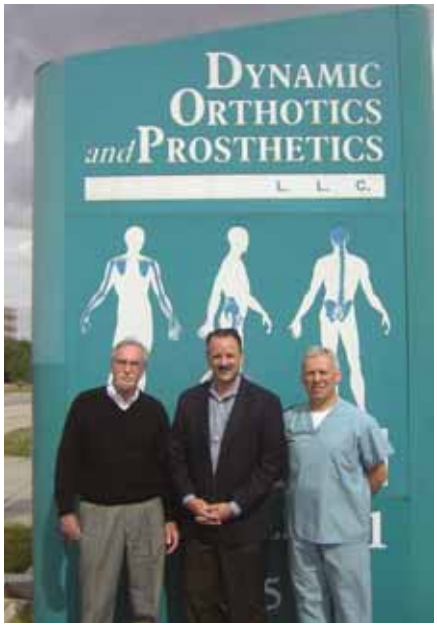
In particular, when prescribing a spinal orthosis, we recommend including: the diagnosis, generic nomenclature, eponym or common name, and additional specifications (e.g., plastic body jacket TLSO for spinal stability, bivalved with soft interface); It is also helpful to indicate the expected duration of wear; and whether the device is to be worn during sleep or in the shower.

Regional Spinal Symposium held by Dynamic Orthotics

In an effort to continually refine its approaches to patient care, Dynamic Orthotics and Prosthetics hosted a spinal symposium this past fall. Directed by Miguel Gomez MD, LO, experts from the surrounding region came together to evaluate the principles of scoliosis bracing that are currently being employed at Dynamic O&P and elsewhere.

Guests included, Bill Barringer, CO, immediate past director of the orthotics and prosthetics department at the Oklahoma University Medical Center, Don Katz, CO, current director of orthotics at Texas Scottish Rite Hospital in Dallas and Tom DiBello, CO, owner and president of Dynamic Orthotics and Prosthetics. Collectively, over 75 years of experience in the field came together to review patient cases and discuss pertinent principles. Topics included the use of CAD-CAM in scoliosis bracing, the importance of alignment and balance, and moment verses point loading of corrective forces.

The Symposium began with a simulated spine clinic, where clinicians reviewed and discussed individual patient cases. The following day began with a lecture by Don Katz Co,LO on a recent study conducted at the Texas Scottish Rite Hospital. The study, which recently won the prestigious Thranhardt award, evaluated the effects of patient compliance on outcomes in the treatment of scoliosis. Lectures by Phillip Stevens CPO,LPO and Miguel Gomez MD,LO were also presented.



Members of the clinical staff at both Dynamic O&P and the Houston Shriners Hospital were also in attendance.

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