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The Use of the Modified Boston Brace System (B.O.B.) For Back Pain: Clinical Indications

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INTRODUCTION

The development of prefabricated thermoplastic orthoses to aid in the treatment of spinal deformities, especially scoliosis, is a recent phenomenon. The first such system, the Boston Brace System,® was introduced only ten years ago. The efficacy and high patient acceptance of these semirigid, closely fitting orthoses resulted in a reassessment of the use of orthoses for spinal disorders, in general.[11]

While a number of spinal orthoses were used in the past for a variety of disorders causing back pain, their use has fallen into disrepute in recent years. There appear to be a number of quite different factors responsible for this, ranging from theoretical concerns about their effect on the long term function and physiology of the back, to poor patient acceptance and compliance.

These orthoses, which included the Norton Brown, Jewett hypertension, and chairback orthosis, were most commonly prescribed for patients complaining of back pain from a number of very different etiologies.[9,10] Unfortunately, careful determination of this etiology of the back pain was most often not done, and orthoses were prescribed indiscriminately, reflecting the ignorance of both orthosis prescriber and orthosis fabricator as to the cause of pain being treated, and the expected effect of the orthosis on the spinal column and its primary disease process.

In addition, these orthoses were often prescribed without concurrent exercise programs, resulting in loss of spinal motion, strength, and, sometimes, further exasperating the back pain when the orthosis was removed.[12,13] Finally, these other orthoses were often bulky and of metal and leather construction, with a limited number of contact sites on the torso and pelvis. Wearers of these orthoses often complained of the orthosis being uncomfortable; and patient compliance was usually low.[3]

Most of the new thermoplastic orthoses developed to treat spinal deformities in children or adolescents incorporated, as a design feature, a forward flexion of the orthosis. This design helped to reduce lumbar lordosis, flatten the back, and increase the torso contact and efficacy of derotation pads placed at the convexities of the curve, or curves.

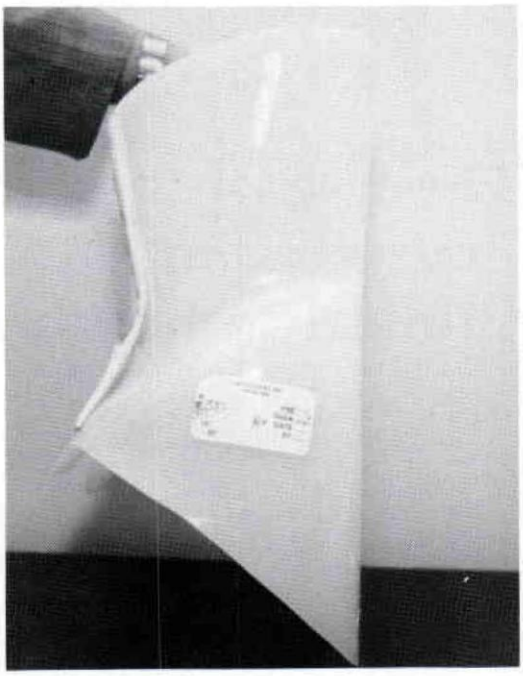
In certain cases, this anti-lordotic feature itself was used to treat children with excessive lumbar lordosis when this was a primary spinal deformity. These conditions included cleidocranial ostosis, achondroplastic dwarfism, and in some instances, idiopathic hyperlordosis. These early cases confirmed the efficacy of this orthosis design in mechanically decreasing lumbar lordosis.

Another clinical application of this anti-lordotic feature of the Boston Brace System® soon became evident. Back pain in athletically active youngsters, although due to a variety of etiologies, including spondylolysis, apophyseal fracture, disc disease, or back strain, appeared to have as a common etiology feature, hyperlordosis of the lumbar spine. This occurred either in the onset of the injury, or in its persistence.[7]

The potential for effective treatment of back pain in athletically active children and adolescents with thermoplastic orthoses was confirmed by extensive clinical trials.

In the process, certain aspects of the orthosis design were changed, and clinical indications were refined. The original orthoses were posterior opening and opening and constructed of polypropylene with semi-rigid ¼" polyethylene liners. A number of different design modifications to this orthosis were subsequently tried. The present unlined, anterior opening, polyethylene with reinforced spring steel "B.O.B. Boston Overlap Brace," is the culmination of these clinical investigations. At the present time, the orthosis is available in either polyethylene, in ¼" or ⅛" thickness, or polypropylene in ¼" thickness. The orthosis is usually prescribed unlined. The B.O.B.® is available in contours of 0°, 15°, or 30° of lumbar lordosis (Figure 1A & B).

The efficacy and high rate of acceptance of these thermoplastic orthoses for back pain in these young athletes, particularly for treatment of spondylolysis, served as an incentive for the use of thermoplastic orthoses in a variety of other back disorders, including low and upper back pain in adults.



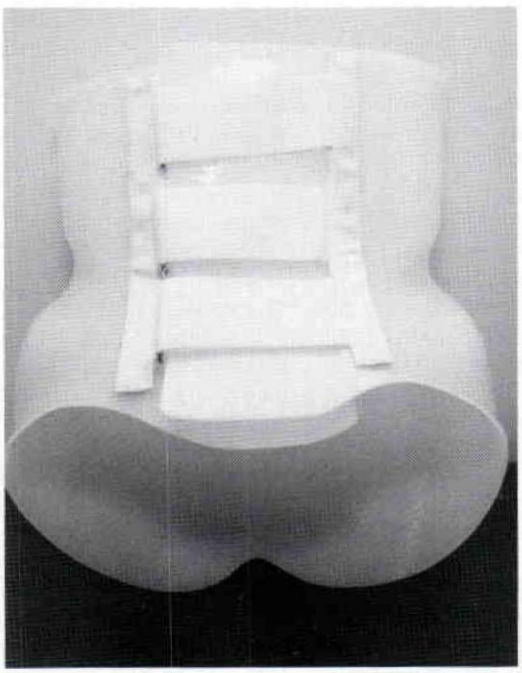


Figure 1A & 1B. The present model of the Modified Boston Brace, the Boston Overlap Brace (B.O.B.). This particular module has 0° of Posterior Lordosis and 30° of flexion of the anterior spring steel ribs.

Experience with the application of this thermoplastic total contact orthosis has proven promising. While this experience is more recent, and study is needed to determine the long term efficacy and effect on the natural history of back pain in adults, the short term observations, in and of themselves, are an adequate basis for our own continued use of this orthosis.

Use of the thermoplastic orthosis, although only one part of a comprehensive treatment regimen, can often prove decisive in restoration of function, by allowing an executive with discogenic back pain to return to work, or a geriatric woman with incapacitating arthritic back pain to resume light housework.

There are, of course, a great variety of etiologies of adult back pain. Some of these are related, as in the case of an adult with previously untreated decompensating scoliosis and secondary discogenic back pain below the curve. Other causes include spondylolysis, facet arthrosis, osteopenic deformity including kyphosis, lordosis, progressive scoliosis, or spinal stenosis. It is imperative to make a proper diagnosis as to the most probable cause of back pain in a given individual and to use orthotics as one component of the treatment regimen. Back pain due to metastatic carcinoma of the spine may indeed undergo symptomatic improvement when placed in a thermoplastic orthosis.

The definitive treatment for the primary condition requires quite different management, of course. Ascribing the source of back pain in such an instance to "mechanical" back pain and failing to do a comprehensive assessment would be tragic indeed. The adjunctive use of thermoplastic orthoses for the management of adult back pain can prove extremely useful for both patient and surgeon, but in no way replaces the careful comprehensive assessment and total management of the patient's condition.

DISCOGENIC LOW BACK PAIN

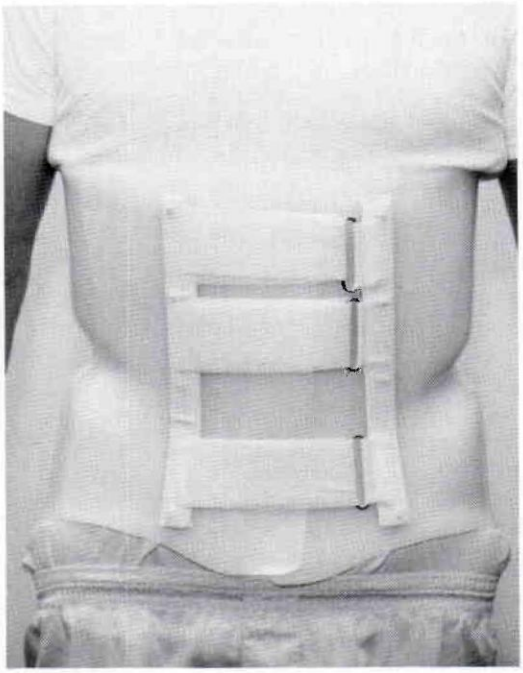
Discogenic back pain, with or without sciatica, can often be improved with the addition of a thermoplastic spinal orthosis to the treatment regimen. Analgesics, muscle relaxants, and exercises to reduce lumbar lordosis, as well as periods of strict bed rest, are time honored components of disc management.[1] The use of a spinal orthosis to not only maintain immobilization of the back, but also to help maintain an anti-lordotic posturing of the back when the patient is erect, has proven useful in many of our patients with disc pain. It is noteworthy, however, that most adults cannot tolerate the full 0° lordosis orthosis. The orthosis with 15° of lordosis has proven most helpful, and in some cases, the 30° lordosis B.O.B.® may be necessary.

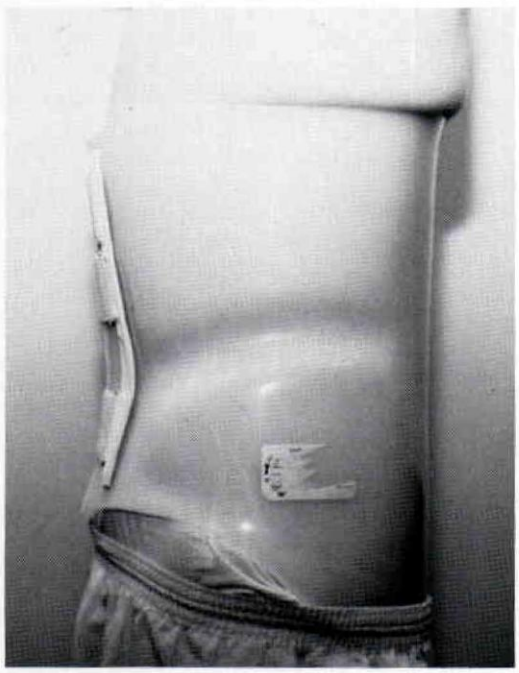
Some insight into the particular orthosis design to be used in a given patient can be gained by manually posturing the patient into more or less lordosis, while standing, and observing the effect on the back or leg pain.

The patient with an acute, incapacitating attack of discogenic back pain cannot be fitted for this orthosis, of course, and usually must be treated with bed rest initially. However, after the acute pain and spasm have diminished, orthotic application and use can often speed return to function.

This application is often particularly useful when sciatic scoliosis is associated with the back pain, as it reduces the decompensation of the spine resulting from the sciatic scoliosis and seems to break the cycle of pain and spasm associated with it (Figures 2A, B, C, & D).

Orthosis use is continued until full painless function is restored. This may be as soon as 12-14 weeks, but a more usual period of orthotic treatment is four to six months. The use of a daily program of directed physical therapy, to restore the strength and motion of the back, is essential. If the patient attains a comfortable and functional improvement with the orthosis, but has resumption of pain when the orthosis use is tapered, further diagnostic evaluation and possibly more aggressive therapy such as laminectomy or chymopapain injection may be required.[2,6]





By experience, some patients with chronic intermittent discogenic back pain and sciatica reach the point where they have significant improvement in function and then will use their orthosis intermittently for particular episodes of back pain following strenuous activity. This will often involve use of the orthosis at night and while up and about working, for a period of two to three days.

SPINAL ARTHROSIS

Some of the most gratifying results of orthotic treatment for low back pain are in patients with extensive arthrosis of the lumbar spine. As with other arthroses or arthritis, anti-inflammatory medications are often important components of the treatment program. However, during the sub-acute period of rehabilitation and

Figure 2. This 42 year old patient has had episodic back pain with sciatica for approximately five years. Lateral radiograph of the lumbar spine (2A) shows degenerative changes and narrowing of the L5-S1 disc space. The patient attained complete relief of both back and leg pain within four weeks of full time orthosis use. A combined orthosis and exercise program was continued for six months. Front and side views demonstrate orthosis fit (2B, 2C).

Figure 2D. The patient demonstrates range of forward bending in the orthosis.

restoration of function, orthoses can indeed be useful. Once again, the patient will not usually be able to tolerate the full 0° lordosis orthosis but can generally and most effectively treated with a 15° of lumbar lordosis orthosis.

It is essential to begin a progressive exercise program in conjunction with the use of an orthosis as soon as possible. Most of these patients have dramatic tightness of the lumbo-dorsal fascia and hamstrings and must be on a good anti-lordotic and good exercise program to restore the flexion and the extension of the lumbar spine and the addition of the flexibility of the lower extremities. In these patients, William[13] type exercises alone may have to be supplemented by the McKensie flexion type exercises to restore the full range of motion and strength of the spine.

It must be explained to the patient that the orthosis is really an adjunct in the restoration of function to their back. It, once again, can be very useful for the first two to three months after an acute episode of back pain, but then is used to help support the back while instituting a progressive exercise program. In addition, it can be extremely helpful to have the orthosis on hand for recurrent episodes of back pain and spasm.

SPONDYLOLYSIS

As in the adolescent with acute spondylolysis, the adult with more chronic spondylolysis can often be significantly helped by an orthosis and exercise program. This adult often has had this condition for a number of years and has associated arthrosis and, sometimes, frank neurologic impingement at this level of the spine.[5] He or she may not be able to be placed initially in a full 0° of lordosis orthosis. We will often begin with a 15° of lordosis B.O.B.® and then contour it into 0° after two to three months.

If the patient is able to retain a very nice level of comfort and function while in the orthosis, but has resumption of back pain whenever he/she begins to wean from use of the orthosis extensively, this may be considered an indication for surgical stabilization of the spondylolysis level. Use of the anti-lordotic orthosis, in particular, seems to be useful in those patients who have a component of sciatica with a spondylitic level.

COMBINED DORSAL KYPHOSIS AND LORDOSIS

Patients with tightness of the spine in association with a dorsal kyphosis and

lumbar lordosis deformity often will have intermittent episodes of mechanical back pain localized to the mid-dorsal area of the spine, thoracal-lumbar junction, or low back.[8] The characteristic clinical picture is that of a patient who is rather dramatically tight in the low back and hamstrings and can often not get within two feet of the floor on forward bending.

Orthotic immobilization, of course, will in no way restore motion to the spine, but the use of the orthosis for the painful episode often dramatically facilitates the relief of pain and the restoration of motion. In addition, the reduction of lumbar lordosis with the 15° B.O.B.® and performing dorsal extension exercises while in the orthosis can be useful in helping to reduce, at least in part, the spinal deformity.

We have found this treatment particularly useful in post-menopausal females with osteopia as a component of a progressive deformity. In some cases, we will use an additional anterior strut to apply anterior chest pressure and help stabilize the upper back until comfort has been obtained.

The relief of pain, which is the direct result of orthosis use, can then be used to facilitate the progressive rehabilitation of the patient with exercises and activity. Then, the patient should be referred to an appropriate rheumotologist or internist to discuss possible nutritional components of the management of their primary osteopenia.[4]

However, it has been well demonstrated that one of the most important components of maintaining bone structure is restoration of exercise and function. The relief of pain and the stabilization of the spine facilitated by the orthotic treatment is often a first important step in the restoration of strength and function to the torso and spinal column.

POST OPERATIVE USE OF THE ORTHOSIS

Thermoplastic orthoses can also be used in the post-operative period in a number of situations involving spinal surgery. We use a B.O.B.® with 15° of lumbar lordosis following fusion for spondylolysis, or any low back fusion in which the basically normal contour of the spine is expected following attainment of fusion. Orthoses are not usually required following simple dissections or chymopapain injection.

REFERENCES

[1]Finneson, B.E., *Low Back Pain*, Philadelphia: J.B. Lippincott, 1973.

[2]Hakelius, A., "Prognosis in Sciatica: A Clinical Follow-up of Surgical and Non-surgical Treatment," *Acta. Orthop. Scand.*, 129 (suppl), 1970.

[3]Jordon, H.H., *Orthopaedic Appliances*, Springfield, Ill: Charles C. Thomas, 1963.

[4]Lane, J.M., et al., "Osteoporosis," *J.B.J.S.*, 65A(2): 274–78, 1983.

[5]Lusskin, R., "Pain Patterns in Spondylolisthesis," *Clin. Orthop.*, 40: 125–36, 1965.

[6]McCulloch, J.A., "Chemonucleolysis," *J.B.J.S.*, 59B: 45, 1977.

[7]Micheli, L.J., Hall, J.E., and Miller, M.E., "Use of the Modified Boston Brace of Back Injuries in Athletes," *A.J.S.M.* 8: 351–56, 1970.

[8]Mooney, V., "The Syndromes of Low Back Disease," *Orthop. Clin. North Am.*, 14(3): 505–15, 1983.

[9]Morris, J.M. and Lucas, D.B., "Biomechanics of Spinal Bracing," *Ariz. Med.*, 21: 170–76, 1964.

[10]Norton, P. and Brown, T., "The Immobilization Efficiency of Back Braces: Their Effect on the Posture and Motion of the Lumbosacral Spine," *J.B.J.S.*, 39A(1): 111–39, 1957.

[11]Stanish, W., Hall, J.E., Miller, W., et al., "The Boston Scoliosis Orthosis," *J. Orthotic Prosthetics*, 29: 7–11, 1975.

[12]Walter, R. and Morris, J., "Effects of Spinal Supports on the Electrical Activity of Muscles on the Trunk," *J.B.J.S.*, 52A: 51, 1970.

[13]William, P.C., "The Conservative Management of Lesions of the Lumbosacral Spine," *Am. Acad. Ortho. Surg. Inst. Course Lecture*, 10: 90–102, 1953.