

Technical note

New concept of spinal orthosis for weakened back muscles

H. WATANABE*, T. KUTSUNA*, T. ASAMI* and E. INOUE**

*Department of Orthopaedic Surgery, Saga Medical School, Saga, Japan

**Division of Nursing, Faculty of Medicine, Saga Medical School, Saga, Japan.

Abstract

An anterior bending posture of the trunk during walking is often seen among the elderly commonly due to weakened thoraco-lumbar and gluteal muscles. For the management of this debilitating condition, the authors have developed a modified design of thoraco-lumbo-sacral orthosis (TLSO). Incorporated in this device are pockets for the accommodation of lead weights, which are located posteriorly at the level of the lumbar region and an elasticated anterior abdominal band. The results and level of patient acceptance achieved with the use of this brace have both been excellent.

Introduction

An anterior bending posture of the trunk during walking often seen among the elderly most commonly arises due to weakened thoraco-lumbar and gluteal muscles (Takemitsu *et al.*, 1988). In order to relieve this awkward posture, and the consequent low back pain which frequently accompanies it, sufferers often place their hands on their thighs to support the trunk (Fig. 1A) or alternatively adopt a posterior elevation of both arms during walking (Fig. 1B). They will as a consequence have difficulty in carrying out normal domestic activities, e.g. the carrying of objects in front of the body or activities of daily living in general. When examining such patients it will commonly be found that they have neither a rigid kyphosis nor indeed any fixed spinal deformity and can

often, at least for short periods, or with assistance, manage to stand erect with pelvis tilted posteriorly and knees slightly flexed (Fig. 1C).

In an attempt to address this debilitating condition the authors have developed a TLSO which incorporates pockets for the accommodation of lead counterweights located posteriorly at lumbar level (Fig. 1D).

Structure of the orthosis

This is similar to that of a conventional thoraco-lumbo-sacral orthosis with the addition of the pockets in the lumbar region and the elasticated abdominal band (Figs. 2 and 3). The weights used vary from between 200-400 grams each, with typically a total of 4 to 6 being used per orthosis. The function of the weights is to shift the centre of gravity of the trunk posteriorly and create an extension moment at the hips and on the spine thus serving to assist

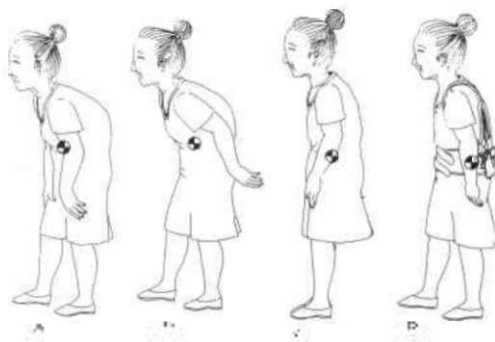


Fig. 1. Characteristic postures arising from weakened back muscles (A,B,C) and improved walking posture achieved with rucksack type orthosis (D). \odot = possible location of the body centre of gravity.

All correspondence to be addressed to Dr. Hideo Watanabe, Department of Orthopaedic Surgery, Saga Medical School, 1-1, Nabeshima 5-Chome, Saga-shi 849, Japan

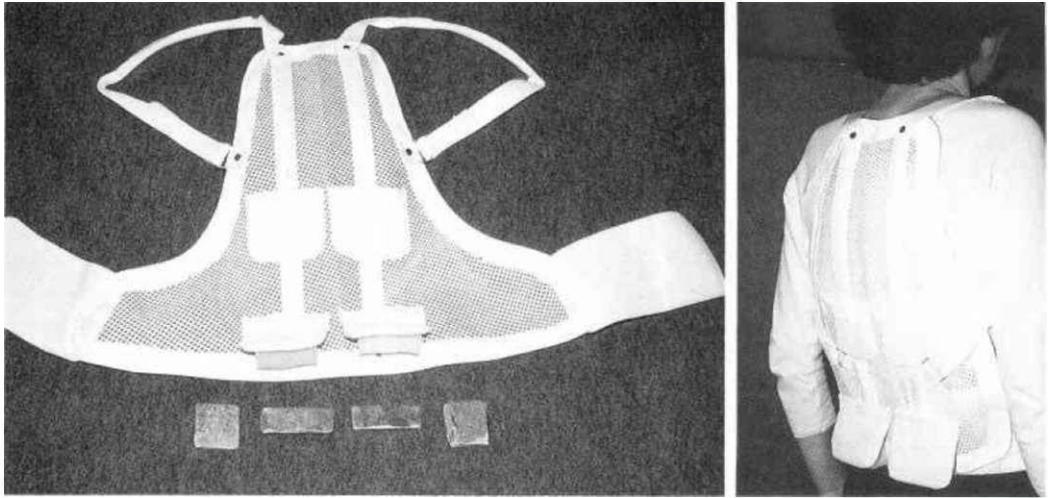


Fig. 2. The thoraco-lumbo-sacral orthosis with 'rucksack type' lead weighted pockets.

the weakened spinal muscles and thereby hold the trunk more erect during standing and walking. In addition to securing the paraspinal steels against the trunk and effecting distal anchorage of the brace, the anterior elastic abdominal band, by its construction, serves to increase the intracavitary pressure which, in turn,

tends to decrease the loading on the spinal vertebrae and discs.

Orthosis function

The concept of the 'rucksack type' orthosis is as follows:

1. The effect of the addition of the lead weights



Fig. 3. Further version of 'rucksack type' orthosis.

is to shift the centre of body weight posteriorly and create an extension moment acting upon hips and spine. This is imparted to the trunk, via paraspinal steels and the anterior shoulder straps thus assisting the maintenance of an erect posture during walking.

2. The anterior elastic abdominal band of the orthosis serves to increase the intracavitary pressure which in turn enhances the support of the lumbar spine.

Results of bracing

The authors have to date prescribed and evaluated this device, the so-called 'rucksack' type orthosis, on a total of 42 patients assessing its effect on posture, pain relief and patient activities. Improvement in spinal posture was assessed by measuring the degree of flexion of the thoraco-lumbar spine during walking using video photographs. The average improvement was 31°. (Table 1).

During the evaluation it was noted that all patients walked with improved posture and were able to perform various activities of daily living much more easily when wearing the orthosis. The one exception was a patient

suffering from Parkinson's disease who did not demonstrate any perceptible improvement.

The optimal total weight of the lead used was found to be from 800 grams to 1600 grams (average 1200 grams). The majority of patients did not complain of feeling the orthosis to be either uncomfortably or unduly heavy. The potential burden of the weights being well dissipated by the combined effects of the well fitted posterior steels, the elasticated abdominal band and axillary shoulder straps.

Discussion

Having noted that patients with anterior bending posture could perform various activities of daily living more easily when wearing a weighted rucksack, the authors, on the basis of this observation, developed the orthosis as described. The combined effect of the orthosis is to support the spinal column antero-posteriorly, the weights serving to shift the centre of gravity of the trunk posteriorly and create an extension moment at hips and spine. With one exception, all patients fitted found the orthosis to be beneficial and were able to walk with an improved posture and also perform various activities of daily living much more easily. The patients did not find the weights to be a burden.

Table 1. Degree of correction using orthosis

| Improvement | Number of patients |
|-----------------------|--------------------|
| Worsened or unchanged | 0 |
| 5° - 10° | 0 |
| 11° - 20° | 4 |
| 21° - 30° | 13 |
| 31° - 40° | 21 |
| 41° - 50° | 4 |
| 51° upwards | 0 |

REFERENCE

- TAKEMITSU Y, HARADA Y, IWAHARA T, MIYAMOTO M, MIYATAKE Y (1988). Lumbar degenerative kyphosis: clinical, radiological and epidemiological studies. *Spine* **13**, 1317-1326.