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TLS Vertebral Extension Orthosis for Osteoporotic Compression Fracture

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Abstract: ***Osteoporosis & vertebral compression fracture have a considerable negative impact on an individual's health related quality of life due to pain & fatigue, limitation in activity & social participation. Vertebral compression fractures are most common at the Thoraco-lumbar junction (T11 – L1) followed by the mid thoracic region & are closely related to the increased thoracic kyphosis. Hyper kyphosis is also associated with back pain & fatigue, reduced respiratory function & gait balance disturbances as the centre of gravity is displaced anteriorly, closer to limits of stability with a subsequent increase risk of falls & fractures as a result of falling.***

Keywords: Osteoporosis, Kyphosis, Spinal orthosis, Compression Fracture

1. Introduction

Spinal orthoses are traditional treatment option for vertebral osteoporosis & Thoraco-lumbar vertebral compression fractures [1]. An orthosis is thought to reduce axial load or compression forces on the Anterior spinal column & fractured vertebral body [2]. In the Acute stage after fracture of orthotic treatment aims to relieve pain, back muscle spasm & to stabilize the spine in order to promote fracture healing in a good alignment while allowing the individual to mobilize [3]. Individuals with osteoporosis and secondary spinal deformity present a unique and complex set of problems that, if not fully evaluated, can lead to unsuccessful treatment [4]. This can quickly become a reality if the rigors of comprehensive orthotic care are not viewed as ongoing for the patient. The patient with osteoporosis likely will present with a multitude of everchanging challenges and will require constant review [5]. Individuals with a diagnosis of osteoporosis with at least one VCF and who range in age from 55 to 80 years shows a significant impairment of quality of life compared to healthy individual of the same age and gender [6]. It is not uncommon for these individuals to have diminished function both physically and socially [7]. It is important that these factors receive as much attention as the more obvious musculoskeletal deficits and associated pain if orthotic treatment is to be successful [8]. Traditionally, orthoses for persons with VCFs secondary to osteoporosis are thought to be a burden and not well received by the patient and the healthcare worker alike [9]. Unfortunately, in many instances the orthotist is likely to read and fill the prescription rather than acknowledge these issues and pursue a comprehensive patient history and physical assessment [10]. More over the orthotist is unlikely to initiate dialogue with the physician and/or medical team members and remain is isolated in providing orthotic care [11]. The orthotist may simply fill the prescription in an attempt to address the VCF and associated pain [12]. The patient often is prescribed a dorso lumbar corset or a three-point hyperextension orthosis [13]. Upon failure of the orthosis, which was intended to reduce pain and improve the quality of life [14].

Aim & Objective:
The aim was to examine the effects of an active vertebral extension orthosis on back extensor strength, chronic back pain & physical functioning with osteoporotic vertebral fractures.

Purpose of Orthosis:
To protect against forces that cause chronic pain, injury, deformity or stress that interfere with healing. To assist movement or joints during functional activities when muscles are weak, paralyzed or spastic. To relieve chronic back pain. Immobilization & protection of weak & painful or healing musculoskeletal segment **into** functional position.

Characteristics: Objective of the treatment should be fulfilled. Reliability, Light in weight, Durable in nature, Manufacturing standards to be maintain, Rapid provision, replacement, easily adjustable, Hygiene, Efficient, adequate in support & Cosmeticaly accepted.

2. Case Study

A 73 years old woman from Cuttack district having name Mrs. Satyabhama Mohapatra with Primary Type-II (age associated) osteoporosis that leads to vertebral compression structure & proportional loss of trabecular & cortical bone. The MRI of the patient revels compression fracture at thoracic & lumbar vertebra patient was found with a hyper kyphosis and chronic back pain.

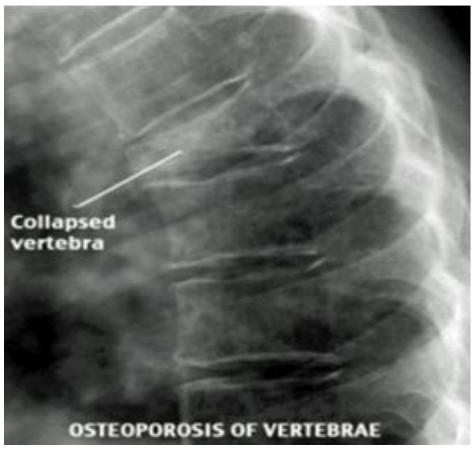

Figure 1

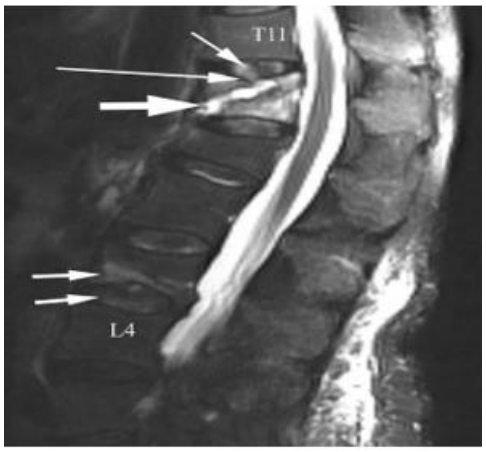

Figure 2

3. Methods

Design Concept: Ergonomically shaped shoulder straps make it easy to put on & increases wearing comfort. Two functional straps ensure a clear, light structure & easy handling when putting it on. Perforated soft material increases air circulating under the posterior spine panel ensuring patient comfort. The newly developed flexible intermediate belt ensures that there is an optimum fit & the belt system works effectively. A flexible & breathable material integrated into the stomach pad provides a good fit & a high degree of wearing comfort. It also facilitates closing under tension. As per the contour of the spine of the body, there are windows which will represent on a normal replica of the spine. Six plastic strap holds, customize & specifically for this brace (a) Upper (2) (b) Middle (2) (3) Bottom (2). As per the required distance achieved with the press button & provides rotational stability.

Working Principle

When you wear the TLS vertebral extension orthosis, your back muscles will be activated. As a result, upper body will be gently straight and countering the curvature of the spine which is typical of osteoporosis. The orthosis stimulates the body own muscle resources. The back splint will have been individually adjusted. Together with the straps, thebrace supports muscles in holding shoulders back & straightening upper body. The brace has been optimally adjusted, can reduce pain & increase day to day mobility.

Mode of Action

Initial stabilization of the spine after osteoporotic bone collapse. Belt system & back support cause activation by triggering bio feedback. Activation of the back muscles strengthens the spine & reduces hyper kyphosis. Reduces chronic pain & promotes muscular activity.

Fabrication process: Casting: Patient on standing position, first of all a wet cast socks was applied. The bony land marks & Trimlines were marked by copying pencil. Outline of scapula, Inferior angle of scapula, C7 vertebrae, Posterior superior iliac spine, Para spinal muscle area All vertebrae bony prominences.

Measurement: Spine length (inches), Measure from the sacrum to just below the C7 following the spinal curvature. ASIS circumference or circumference of Axilla Width of vertebrae ½ inch margin on both sides.

Figure 3

Figure 4

Modification: It was done by the required spinal curvature as per biomechanical principles.

Molding: Take 6 mm PP Sheet & Cut it according to the measurement with the help of Jigsaw Machine. Put it in the oven & do the molding.

Figure 5

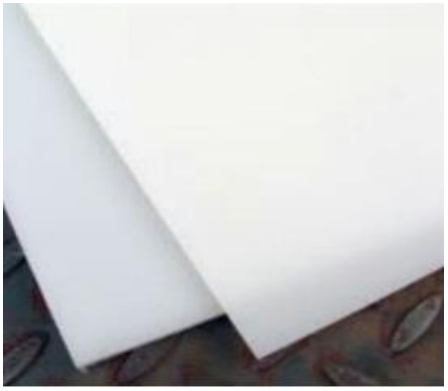

Figure 6

Figure 7

Figure 8

Materials: Polypropylene sheet (Plastic) white & Brown 6mm Press buttons/Rivet (Aluminum & copper) 2 inch Velcro hook & loop-straps D-Buckles.

Figure 9

Figure 10

Figure 11

Figure 12

4. Results

Wearing the TLS vertebral extension orthosis for 3 month period was associated with a 73% increases in back extensor strength. 58% increase in abdominal flexor strength. 11% decrease in Angle of Kyphosis. 38% decrease in Average pain. 25% decrease in body sway. 27% decrease in limitations of daily living. The Orthosis provided effective application of corrective forces & the posture of the patient improved considerably.

Advantages:
Easy to fabricate. Light in weight Comfortable for patient. Wearing a TLS vertebral extension orthosis over an intervention period of 6 months improve posture, trunk muscle strength & quality of life in women 60 years of age with post-menopausal osteoporosis with clinical cerebral fractures. All spinal devices employ three-point pressure over bony prominences to cause enough discomfort to remind the patient wearing the orthotic to change or maintaining posture in the orthotic device.

5. Conclusion

The potential effect of spinal orthoses on people with osteoporosis at all levels of impairment, activity & participation. The particular outcomes of interest are measures of body structure and improvement, including: fracture consolidation, pain, spinal range of movement (ROM), spinal posture muscles strength, balance, measures of physical activity & function e.g. walking speed, activities of daily living (ADL) & measures of participation e.g. Health related quality of life.

Declaration by Authors

Ethical Approval: Approved

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Conflict of Interest: The authors declare no conflict of interest.

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