

Quadruple Hip Joint Calipers for Extensive Neuromuscular Disorders

by Lt. Col. B.P. Mathur

INTRODUCTION

Conditions such as poliomyelitis, paraplegia, muscular dystrophy, and spina bifida, at times require attachment of spinal extensions to above knee orthoses.

In the full body orthosis (Figure 1) in which the hip and knee joints are kept locked to maintain the patient in an upright position, it is very difficult for the patient to ambulate. In such circumstances, "Tripod walking" with the aid of crutches is recommended. The energy requirement for such a method of ambulation is considerable and thus limited to short distances. Alternately, the patient may resort to walking by a shuffling mechanism in which he rotates the whole of his trunk and slides one leg forward after the other, in a zig-zag fashion, making it very difficult for the patient to progress.

To overcome some of the above problems and to allow them some mobility within reasonable safety, Quadruple Hip Joints, in which some movement is allowed at the hip, have been introduced in such an orthosis. Such modification makes it possible for the patient to adopt a modified bipedal gait.



Figure 1. Conventional full body orthosis.

QUADRUPLE HIP JOINTS

Instead of two hip joints, as in the conventional bilateral knee ankle foot orthosis, with spinal support, four hip joints, two on either side, have been incorporated in the orthosis designed by the Artificial Limb Centre (Figures 2 and 3).

The lower two hip joints are located at the anatomical hip joints, and are provided with a spring loaded locking mechanism.

Two more hip joints with limited range of movement, allowing about 15° of flexion and extension, are incorporated at the level of the anterior superior iliac spines.

By allowing limited range of movement at the upper free hip joints, it is possible for the patient to adopt a bipedal gait (Figure 4). To ambulate, the patient utilizes his trunk muscles. The forward thrust produced by the shoulder and trunk results in movement of the legs forward, alternately. However, to walk with such an orthosis, they do require the help of walkers or crutches.

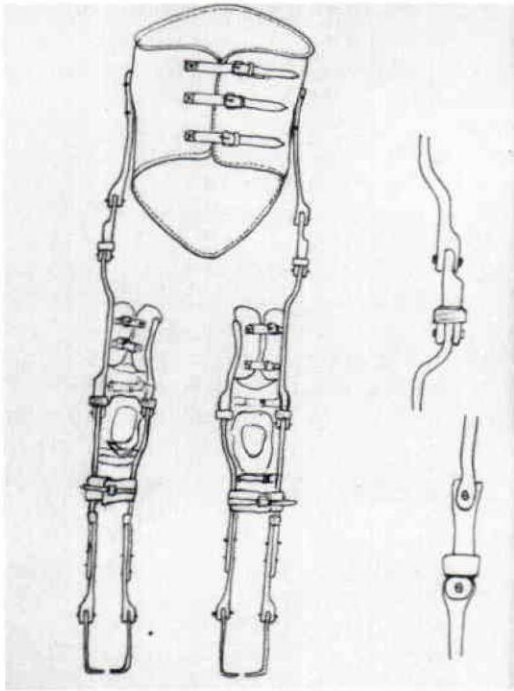


Figure 2. Line drawing of the Quadruple Hip Joints.



Figure 3. A close up of the Quadruple Hip Joints.



Figure 4. A child walking with the help of Quadruple Hip Joint T.L.S.H.K.A.F.O.s.

DISCUSSION

In extensive neuromuscular disorders with involvement of spinal musculature, in addition to involvement of both lower limbs, rehabilitation in walking with the aid of orthoses is a very difficult problem.

Though such patients use wheelchairs extensively and are able to lead a more active life with its help, it is important for them to attain an erect posture and undergo some mobility in order to prevent the complications of confinement to a bed and wheelchair.

Ambulation with the help of conventional whole body orthoses with locked hip and knee joints is very tiring, dangerous, and allows only limited activity. However, it does enable the patient to stand for longer periods of time and allows him to do his work in a standing position. The majority of such cases, after initial enthusiasm, reject such orthoses and resort to a wheelchair life, because in addition to the cumbersome device they have to wear, it really does not help them much in mobility. They are too apprehensive to resort to a tripod walking gait due to the fear of falling down, more so if the patient is overweight, which they tend to become due to prolonged bed rest and lack of physical activity. Furthermore, ambulation in such a manner is too tiring, and thus of little help to the individual.

Introduction of Quadruple Hip Joints, with limited range of movements at the upper hip joints, allows the patient to stand erect as well as ambulate using a modified bipedal gait. When the patient performs shrugging movements with the help of the thoracic and shoulder muscle groups, it results in movement of the supported limbs forward, with the movement taking place at upper hip joints. The patient walks by taking short steps alternately with the aid of crutches or a walker. The patients are able to walk easily, without getting tired, for reasonable distances on flat surfaces, indoors as well as outdoors.

CONCLUSION

Modification of conventional full body orthoses, by incorporation of quadruple hip joints, has benefitted such severely disabled patients in adopting a more safe and less tiring modified bipedal gait.

Most of the patients fitted with such orthoses were extremely happy and could lead a more active and useful life with the help of orthoses and wheel chairs.

AUTHOR

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