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Effect of bracing on rate of resolution in postero-medial bowing of tibia: A short term case study

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Abstract

Congenital postero-medial bowing of the tibia (PMBT) and fibula is an uncommon anomaly of unknown etiology and pathogenesis. It is associated with soft tissue contractures at the dorsum of the ankle joint. Evidence suggested that the role of bracing is to improve its function, but none proposed the impact of orthosis on early resolution of mal-position. This case study documents the use of dynamic, hinged ankle foot orthosis using therapeutic stretching techniques in a three years, four months child with PMBT and its relation with rate of resolution of deformity and gait. Direct relationship between bowing angle and leg length discrepancy was observed. The use of brace indicates a higher rate of resolution and an improved symmetrical gait by placing the foot flat to allow walking. Thus, the innovative design for Ankle foot orthosis treatment used in this study is effective in controlling the progression of the deformity and preventing other associated complications.

Key Words: Ankle foot orthosis, Gait, Malposition, Posteromedial bowing, Resolution

Introduction

The congenital postero-medial bowing of tibia and fibula is accompanied by shortening, an initial calcaneovalgus deformity of the foot, and a decrease in the ankle motion that does not improve with age,(Pappas, 1984). This is a rare entity and only a few cases have been discussed in the literatures (Yadav & Thomas, 1980).Treatment options vary depending on the degree of limb-length inequality, age of the patient, expected height, and desires of the patient or family. The principle of orthotic management is alteration of abnormal compressive forces so that normal growth will resume with the correction of the deformity. Fractures are common so prophylactic orthoses may be used whenever child is weight

bearing to prevent development of pseudarthrosis (Jugesh *et al.,* 2003). There is no specific orthotic recommendation for this group of patients but occasionally an ankle foot orthosis (AFO) is sometimes recommended, but no outcome studies or significant published series document its effectiveness (John *et al.,*2008).

We present a usual presentation of congenital postero-medial bowing of tibia managed successfully with orthosis and its short-term effects.

Case analysis

A 3 yrs 4 months old female child presented to the Prosthetics & Othotics, Department of NIOH with right tibial bowing presented since birth, a dimple in the skin posterior to the apex of the bow, calcaneovalgus deformity of the foot. The Galeazzi test was found to be positive (Fig. 1a). Ipsilateral leg length shortening of 1.5 inch was noted in supine position (Fig. 1b). Limitation of range for foot plantar flexion and inversion was observed. The Antero-posterior radiograph of the child revealed medial tibial bowing and lateral radiograph revealed posterior tibial bowing at the distal 1/3rd of the leg (Fig. 3a). The child was able to walk with some difficulty due to elevated forefoot on right side.

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Fig 1a. Showing Galeazzi test-positive

Fig 1b & 1c. Showing posteromedial bowing of Tibia

Fig 2. Showing anterior, posterior and lateral view of orthosis respectively

Fig 3a, 3b & 3c. Showing radiograms a month (before use), 3 month and 6 month after orthosis use

The patient was fitted by an innovative design of custom molded dynamic AFO. The design features include total contact circumferential design with hinged ankle joint, posterior spring or elastic, pressure pad at the apex of the curve, soft lining and 1.5-inch shoe compensation in the affected side (Fig. 2a-2c).

The mother was advised to correctly put the orthosis to the child daily for a minimum of 20 hours. The radiological findings were taken into account for checking the effectiveness of the orthosis. Radiograms were taken just before the orthotic treatment, three and six months after orthosis use. Bowing angle of distal tibia was taken into an account to check the improvement of angular deformity. To measure this angle the two perpendicular lines were constructed to the base lines drawn at the base of starting and end of the curvature.

Results & discussion

The angulations observed during the reporting of the patient based on radiological findings were tibio-femoral angle of 23^{o}, posterior bowing of 57^{o} and medial bowing of 45^{o} (Fig. 3a). Both 3 months and 6 months of follow up of the patient showed a marked improvement in bowing angles. The 3 months follow up of radiogram revealed that, angle for posterior bowing of 25^{o} and angle for medial bowing of 31^{o} (Fig. 3b) and in the radiogram of

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6 months follow up the bowing angle was again reduced to 15^{o} for posterior bowing and 22^{o} for medial bowing (Fig. 3c). However, the tibio-femoral angle remained constant for all these follow ups (i.e. 23 ^{o}).

The important aspect of treating children with tibial bowing is to identify cause i.e. physiological or pathological. Physiologic bowing will improve as the child grows without treatment, while pathologic bowing will tend to worsen over time without treatment. The child was kept under observation for two years after birth to achieve spontaneous physiological resolution of postero-medial bowing of tibia. The dynamic AFO fitted was based on 3-point force system in which the corrective force by the pressure pad located at the postero - medial apex of the curvature supported by counter forces from the anterior and lateral sides of the circumferential design. The spring or elastic attached at the posterior aspect enhances the stretching effect of the contractile tissues like as therapeutic management.

The purpose of this study was to check the effectiveness of dynamic AFO on the rate of resolution of postero-medial tibial bowing. The results showed marked improvement in bowing angle and increased rate of resolution. The resolution of 42^{0}and 23^{0} was observed for posterior and medial bowing respectively after six months follow up. The results of this study are supported by earlier reports. Rastogi (2008) stated that calcaneovalgus deformity resolves spontaneously within two years but splinting, casting or stretching of the affected foot can accelerate resolution (Rastogi, 2008) With improvement in bowing angle, the leg length discrepancy was reduced to 0.75". Earlier investigations suggested a direct relationship between the degree of initial tibial bowing and the severity of the subsequent leg-length discrepancy (Hofmann & Wenger, 1981).

The rate of resolution of deformity was noted from sequential radiographs and expressed as percentage reduction per month of follow-up. The improvement percentage of 73 and 51 was observed during six months i.e. the rate of resolution was 12.16% and 8.5% per month. Shah et al. 2009 suggested that two distinct mechanisms were responsible for resolution of the deformity; one involves physeal realignment and the other involves diaphyseal remodeling (Shah *et al.,* 2009).

Though the deformity usually resolves with growing age to some extent, the use of conservative management by casting or orthosis cannot be neglected. This fact has been well established in some of previous investigations. A review of the literature indicates that non-operative treatment is usually successful in correcting the deformity (Bray & Follows, 1975). The gait of child improved compensating leg length discrepancy that was natural, symmetrical and foot being flat on ground during weight bearing as noted during observational analysis. Therefore, the use of AFO in postero-medial bowing of tibia should be encouraged once the child is ready to stand and walk to keep the foot flat on the floor and not rolling inward excessively.

Conclusion

The innovative design of AFO used in this study is effective in controlling the progression of the deformity, preventing other complications etc. The use of orthosis with therapeutic effect can markedly improve the rate of resolution of deformity. A good follow up of the patient can give marked correction of the deformity with improved gait.

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