

Orthotic Management of Legg-Calvé-Perthes Disease in a Rare Socio-Economic Condition: A Clinical Case Report

Bapina Kumar Rout¹, Jaishankar L², Brightex Jacob³

¹Master in Prosthetics and Orthotics, Assistant Professor, ISHWAR Institute of Prosthetics and Orthotics, AA-23, 3rd street, 3rd main road, Annanagar, Chennai-600040

²Bachelor in Prosthetics and Orthotics, Final year student, ISHWAR Institute of Prosthetics and Orthotics, Chennai

AA-23, 3rd street, 3rd main road, Annanagar, Chennai-600040

³Bachelor in Prosthetics and Orthotics, Regional Manager, Southern region, Endolite India Limited, Chennai AA-23, 3rd street, 3rd main road, Annanagar, Chennai-600040

Corresponding Author: Bapina Kumar Rout

ABSTRACT

Background: Although the orthotic treatment of Perthes disease has mixed evidences, still it remains as the mainstay of conservative management in economically developing countries, where expensive surgical procedure and availability of a skilled surgeon are tangible limitations. Nowadays the increasing cost of functionally good orthotic devices also further complicates the rehabilitation process.

Objective: Thus the aim of this study was to design an orthotic hip joint for Legg-Calvé-Perthes disease that would be functionally effective and affordable.

Study design: Case report

Methods: Subject reported was a 10 year old male child with a Waldenstrom grade –I right hip Perthes disease and belonged to low socio economic background. A Hip abduction orthosis with two planes of hip ROM adjustment was designed by the clinical team and the subject was followed prospectively for next 4 years using the orthosis.

Discussion: The socio economic condition of the subject triggered for a conservative management in the form of a newly designed hip abduction orthosis. Affected hip was maintained in 30 degree of abduction, 15 degree of internal rotation and 10 degree of hip flexion. Knee ROM was not restricted and the results were overwhelming with Stulberg grade II hip joint at the age of 14.

Key words: Legg Calve Perthes disease, LCPD, Hip Abduction Orthosis, Legg-Calve Perthes disease conservative treatment

INTRODUCTION

Perthes disease is a rare childhood condition that affects the hip. It occurs when the blood supply to the rounded head of the femur (thigh bone) is temporarily disrupted. Without adequate blood supply the bone cells die, a process called avascular necrosis¹. An incidence study conducted in parts of southern India revealed incidence of Perthes disease ranged from mere 4.4 per 1000 children to as high as 14.8 per 1000

children² of which Prevalence was higher in rural areas as compared to urban areas. General age of presentation was higher when compared to the Europe and normally ranged between 5-14 years. The available evidences are weak in favor of the surgical procedures as well as for the orthotic intervention³. Also some evidences supports simple rest and anti-inflammatory only. Thus in a developing country like India where lack of skilled surgeons and

related expenses makes surgical intervention of Legg-Calve-Perthes disease needless and should be avoided until it turns in to a really bad deformity of hip.

The state of the art orthotic braces for Perthes are increasingly motion compliant when compared to their conventional counterpart^{4, 5}. These braces maintains the hip joint in abducted and flexion attitude and ranges just above the knee joint only sparing all the knee range of motion. This state of the art knee brace for Perthes are called Hip Abduction orthosis. The most important aspect of all these devices is the provision for flexion and abduction in order to obtain complete containment of the soft femoral head within the acetabulum. But studies show that these hip abduction orthosis used are complex and at the same time are too expensive to be affordable to economically weaker section of society⁶. The present study aimed at designing a cost effective hip abduction orthosis with 2 plane of hip adjustment. So that it can avoid unnecessary surgery and replace expensive orthotic components in the market. The current design avoids the connecting bar between the thigh cuffs as available on the former orthotic designs as well as provides adjustment in both frontal and sagittal plane for effective hip containment.

METHODS

Subject

The subject was a 7 years old male child reported with mild pain in right hip on weight bearing. On radiologic evaluation an ischemic induced sclerosis was found and it was categorised under grade-I Waldenstrom classification of Legg Calve Perthes disease⁷. Pain level was assessed with the Visual Analog Scale (VAS) on a 0 (no pain)-100 (worst pain imaginable) mm range.

Clinical decision

Though the patient was in his initial stages of Perthes disease and belonged to a poor socio-economic group, the preferred mode

of treatment was conservative treatment in form of Hip abduction orthosis. Then the patient was referred to the orthotic department for brace management.

Fabrication procedure

Fabrication of dial lock for hip flexion-extension control

A circular aluminum coupling (dial lock) of 40mm diameter with flexion and extension control on every 15° was designed. The dial lock can be adjusted for required flexion and extension with the help of screws. (Figure: 1)

Fabrication of serrated locking plates

Serrated locking plates meant to provide hip abduction adjustments, can be adjusted and locked form-fit at a defined angle of 20° interval. Serrations are meant for firm and sturdier control of hip abduction and both the plates are joined with the help of screws. (Figure: 1)

Auxiliary attachments

Both dial lock and serrated plates are attached to proximal and distal uprights respectively. Subsequently the proximal upright is attached to the pelvic band and distal uprights are attached to the thigh cuffs. Both pelvic band and thigh cuff suspensions are aided by the straps.

Measurements and assembly

Both length measurements and circumferential measurements were taken while patient was maintaining a supine lying position on examination couch. Dial lock center (Hip joint center) was approximated at apex of the greater trochanter for flexion-extension control and serrated lock for abduction-adduction control attached below to the dial lock. Pelvic band circumference was decided upon circumference taken from just lateral to the affected sides ASIS to the PSIS. Pelvic band was placed between iliac crest and greater trochanter of the affected side. Thigh cuff was half of the thigh circumference and entire length of orthosis ranged from just below the iliac crest to just

above the knee joint on affected right side only.

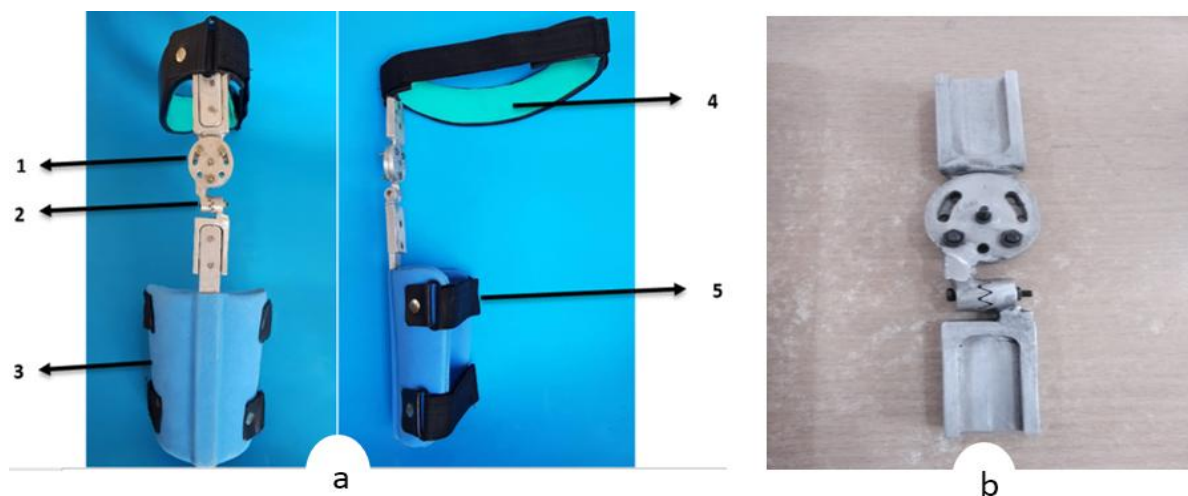


Figure 1 (a): Hip abduction orthosis with its different parts; 1. dial lock, 2. serrated locking plates, 3. Thigh cuff, 4. Pelvic band, 5. Straps. **Figure 2 (b):** Newly designed hip joint with dial lock and serrated plates.

Patient evaluation on the orthosis and follow-up

With the new orthosis the patient's hip was maintained in 30 degrees of abduction, 15 degrees of internal rotation and 10 degrees of flexion⁸. (Figure 2) This simultaneous abduction, internal rotation and flexion of the hip are the position of excessive containment of head of the femur inside the acetabulum for remolding and revascularization. The orthosis wearing time increased gradually from 3-4 hours a day to 18 hours a day. The patient was followed prospectively for next 4 years until a satisfactory head molding was achieved.

The Stulberg classification is considered a gold standard for rating residual head deformity and joint congruence after the Perthes disease. Stulberg classification is strongly prognostic of long-term evolution of hip normalcy or arthritis in future⁷. The healed head of femur was rounded with smooth subchondral layer but overall size of the head was enlarged (mushroom shaped). The shape of the femoral head achieved was satisfactory and was categorised under Stulberg grade-II hip after a thorough evaluation of hip roentgenogram (figure: 3). According to Stulberg classification, grade-II residual hip has a very good prognosis in near future

without any joint deformity. The pain level (VAS) assessed at the end of the treatment procedure was satisfactory.



Figure 2: Patient wearing the newly designed hip abduction orthosis with hip maintained in 30 degrees of abduction, 15 degrees of internal rotation and 10 degrees of flexion

DISCUSSION

The Atlanta Scottish rite orthosis developed in 1978' and found to be the most widely used orthotic device for the treatment of Legg clave Perthes disease⁵. But the connecting bar between the thigh cuffs in this design was a major limiter of knee motion. Subsequent development and evolution of this orthotic design was able to eradicate the joint limitations but

simultaneously increased the cost associated with it.

The current design of the hip abduction orthosis provided 2 plane of motion control i.e. sagittal and coronal plane for required hip joint control and at the same time it is inexpensive. The combination of correct clinical decision making at right time and proper prosthetic device technology fetched a good outcome.

Waldenstrom classification system with a very good reliability should always be used for deciding the existing stage of

Perthes disease so that correct mode of clinical treatment can be administered at right time. Administration of orthotic intervention is highly rewarding at stage –I and stage-III of Waldenstrom classification system⁷.

Stulberg classification of residual hip assessment is considered a gold standard for evaluating future prognosis of the joint. Residual hip with poor future prognosis should accordingly set a long-term rehabilitation plan for a disability free life⁷.



Figure 3 (a): Roentgenogram of patient at the age of 10 with Waldenstrom grade-I hips showing ischemic induced sclerotic patches and subchondral irregularities.

Figure 3 (b): Roentgenogram of the patient at the age of 14 showing residual hip with Stulberg grade- II hip (good prognosis). The residual hip is circular with smooth edges but apparently enlarged.

CONCLUSION

This orthotic design was able to meet its two prime objective of functionality and cost effectiveness. The residual hip achieved was a Stulberg grade-II type with good prognostic future. The orthotic intervention not necessarily should always form the main stay of treatment method; rather it should be in conjugation with other form of treatment modalities available. A through patient evaluation, rationale based clinical decision making at different stages of Perthes disease is the way to a successful rehabilitation. In near future more options in terms of functionality and cost effectiveness of orthotic components should be developed,

so as to deliver best clinical care possible to all.

Learning from this study

All the stake holders that are associated with the clinical service delivery to the patients should focus on developing a system of clinical care that should be accessible to all. Clinical service delivery should base on rational decision making and administration of proper form of care at right time. Indigenous orthotic components and products that are functionally superior and inexpensive should be developed in developing countries like India so that clinical care remain be accessible to all

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Authors' Contributions

The submitted manuscript presented here in the form of a case report, is a recount of original clinical condition of Perthes disease reported to the organization for supportive Orthotic Brace treatment. The entire patient assessment, fabrication and fitment of orthotic device was carried out by Mr. Jaishankar L (final year BPO, IIPO) under the clinical guidance of Mr. Bapina Kumar Rout (Assistant Professor, Prosthetics and Orthotics, IIPO). Design idea of noble mechanical Hip Joint used in the Orthotic Brace was sought out from Mr. Brightex Jacob (Southern regional manager Prosthetics and Orthotics, Endolite India Ltd). All the authors have contributed to the subsequent data compilation and manuscript preparation equally. The entire courses of clinical procedures were carried out in well-established resource settings of ISHAWAR Institute of Prosthetics and Orthotics.

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