Case Report:
The Effectiveness of a Hip Abduction Orthosis for Perthes Disease

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Abstract: Perthes disease is a rare childhood disorder of femoral head resulting from temporary compromise of tenous blood supply. If untreated it can produce a permanent deformity of the femoral head which increases the risk of developing osteoarthritis in adults. Conservative treatment options like traction, brace or orthosis and physiotherapy are used for achieving goals like removing mechanical pressure from hip joint, decreasing pain, reducing loss of hip motions, preventing or minimizing permanent head deformity so that risk of severe degenerative arthritis can be reduced. The aim of containment is maintenance of articular congruity to aid femoral head-acetabulum reciprocal remodelling. To obtain this, it is necessary for the acetabulum to contain the femoral head, through 30°–45° abduction, 10° flexion and internal rotation of the affected hip. The containment methods were several braces and casts such as the Toronto brace (3), the Tachdjian brace (4), the Birmingham brace (5), the Petrie plaster (6), the Newington brace (7), and the Atlanta Scottish Rite brace. However the quality of evidence that supports conservative treatment for children with Perthes disease is not of high quality and more research is required to determine the effectiveness of orthotic treatment. The aim was to check the effectiveness of a trilateral hip abduction brace in unilateral involvement of Perthes disease.

Case Report
Eight years old male child diagnosed as perthes disease of his right hip referred to Department of Prosthetics & Orthotics, SVNIRTAR for orthotic management by an Orthopaedic specialist with a limping gait. There was no disturbance of general health but he had a history of falling on floor in February, 2015. His chief complaint was pain in right hip since last few months, difficulty in moving the limb. On observation, wasting of muscles in right thigh was observed. On palpation, pain and tenderness in right hip was observed. Range of motion examination of right hip revealed 130° flexion – extension, 50° abduction, 30° adduction, 60° external rotation and 25° internal rotation. Radiographic examination showed avascular necrosis of right hip joint, mixed osteopenia and sclerosis, degenerative changes, positive extrusion, medial joint space widening, subtle flattening of femoral head indicating progression of disease from stage 2 to stage 3 (10) of Perthes disease. Some of the significant pathological examinations revealed increased hematocrit value of 38.7% (normal being 45%), increased platelets count of 428000/mm³ (normal being 100,000), reduced eosinophil of 1% whereas results of biochemistry examinations were normal. Keeping the goal of treatment to help the femoral head recover and grow to a normal shape and to achieve good containment, therapeutic managements like active assisted movements, stretching of quadriceps, glutei and abductors were advised and continued for one month. A Trilateral Hip Abduction Orthosis was planned, fabricated and fitted to maintain affected right hip in 30° abduction, 5-10° flexion and internal rotation.

Key Words: Abduction, Ambulatory, Orthosis, Perthes disease
rotation. The basic principle was to achieve ischial weigh relieving, maintenance of proper position for healing. Treatment rationale was set so that the femoral head will re-form if weight bearing is allowed in the abducted position during regeneration phases of the disease. The orthosis consisted of quadrilateral ischial gluteal socket (trilateral) unweighting affected hip, medial upright with drop-lock orthotic knee joint, rocker bottom, calf band, foot drop ankle joint and appropriate shoe build up on the sound side (Figure 1). The shoe was attached laterally in such a way that neither any portion of shoe touches the ground nor any part of heel touches insole of shoe. It is also important to check that during kneeling the orthotic knee joint touches floor and anatomic knee remains unweight so as to protect hip joint. (Figure 2) Proper gait training was given to subject making him enable for independent unsupported walking and encouraged to perform all normal activities so long as the weight bearing through ischial tuberosity was maintained. Both subject and parents were instructed regarding the use, maintenance of brace and importance of forces through ischial tuberosity. Instructions were given for regular follow ups in every month with standing weight bearing anterior-posterior pelvic x – rays to check effectiveness of the brace and miss out any bilateral involvement.

Figure 1: Different views of trilateral hip abduction orthosis.

Figure 2: Check out during kneeling

Figure 3: Calculations of radiologic parameters in pre and post conditions

Figure 4: Pre and post radiograph findings showing improvements in containment and spherical shape of femoral head
The parameters studied in anterior-posterior pelvic radiograph were Acetabular Head Index (AHI) as used to guide to reveal abnormal lateral displacement of the femoral head. Mohr Concentric Circle Template Method (MCCTM) to access spherical shape of femoral head, Center Edge Angle (CEA) for assessing better femoral head coverage and Articulo-Trochanteric Distance (ATD) (11), position of hip center, congruency in pre and post orthotic fitment conditions (Figure 3). The results are presented in Table 1. The congruency was achieved by matching between acetabular margin and outline of femoral head as revealed from radiographic finding in post fitment condition.

<table>
<thead>
<tr>
<th>Orthotic Conditions</th>
<th>AHI</th>
<th>Mcctm (mm)</th>
<th>CEA(deg.)</th>
<th>ATD</th>
<th>Position of hip center (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Orthotic</td>
<td>80.5</td>
<td>7</td>
<td>27</td>
<td>Positive</td>
<td>12</td>
</tr>
<tr>
<td>Post Orthotic</td>
<td>100</td>
<td>1.5</td>
<td>44</td>
<td>Positive</td>
<td>&lt;10 mm</td>
</tr>
</tbody>
</table>

Discussion: Considering the controversy in orthotic management (12,13), this case report aimed at checking effectiveness of a trilateral hip abduction orthosis in a child with perthes disease. The subject was very active school going child wanted to interact and play with his peers. Therefore objectives of our treatment was to preserve a normal femoral head outline and acetabular-head congruity and maintain a normal range of motion of the hip, given the patient a painless and useful weight-bearing joint, achieve mentioned results without confining him for years in bed, in an institution or at home, by allowing him to be ambulatory, performing activities of daily living as near normal as possible and with the least discomfort.(14)

Evidence relating to the effectiveness of the orthotic treatment method used was found to be conflicting. However the results of this study is supported by a recent study, a high proportion of spherically congruent hips was observed for patients of all ages irrespective of the extent of disease.(17) In contrast, some researchers have also advocated that weight bearing abduction brace for treatment of severe Perthes disease is not recommended.(18) Similarly others have found it hard to justify weather good results were stemmed from good prognosis of subjects or positive effect of using orthosis. However in our case study, we found that all factors mentioned earlier may be responsible for achieving success in group A Perthes disease.

Extensive quantitative analysis may be required to evaluate the effectiveness of these orthoses including a long term study to avoid the controversies. We have used only radiographic findings as parameters for assessment, whereas other methods can be utilized for its reliability and generalization of result. There is also a need to design and develop an abduction orthosis with better function and good cosmetic appearance.

Conclusion
The weight relieving trilateral hip abduction orthosis is effective in mild to moderately involved Perthes disease (Group A according to Salter – Thomson classification). However other factors like proper instruction to subject and parents regarding use and maintenance, degree of involvement of femoral head and age are crucial to achieve a better result.

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References


