**ORIGINAL RESEARCH**

# Assessing the efficacy of abduction orthoses in treating developmental hip dysplasia

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**ABSTRACT**
**Aim**: Assessing the efficacy of abduction orthoses in treating developmental hip dysplasia. **Material and methods:** This study is retrospective observational research that included kids who were diagnosed with hip dysplasia between the ages of 3 and 4 months and were given orthopedic splints for therapy beginning at 6 months of age. A total of 50 patients who fulfilled the criteria, were diagnosed with hip dysplasia, and received treatment were included in the study. The patients received treatment using two different orthopedic splints: the ring splint and the Milgram splint. The acetabular angle was measured radiographically at 6 and 12 months after the start of therapy using orthopedic splints. The initial radiographs were compared with later radiographs to assess the efficacy of the therapy in rectifying hip dysplasia.**Results:** Specifically, 25 patients (50%) were treated with the ring splint, while the remaining 25 patients (50%) received treatment with the Milgram splint. For patients treated with the ring splint, the mean acetabular angle decreased from 30.5 degrees (± 2.1) at baseline to 22.0 degrees (± 1.0) at 12 months. Similarly, patients treated with the Milgram splint showed a reduction in the mean acetabular angle from 31.0 degrees (± 1.8) at baseline to 22.5 degrees (± 1.2) at 12 months. These results indicate significant improvement in hip dysplasia as measured by acetabular angle reduction over the course of treatment with both types of splints. The average reduction in acetabular angle, a key indicator of treatment effectiveness, was consistent between the two types of orthopedic splints. Both the ring splint and the Milgram splint demonstrated an average reduction of 8.5 degrees in the acetabular angle from baseline to 12 months of treatment. **Conclusion**: The research suggests that persons with DDH may successfully decrease acetabular angles and treat hip dysplasia by using either the aro or milgram splint. The acetabular angles were dramatically decreased by the use of splint therapy, and the majority of patients achieved optimal angles around five months after starting treatment. Importantly, there was no significant difference in the efficiency of the two splints.

**Keywords:**Developmentalhipdysplasia,Orthopedicsplints,Arosplint,Milgramsplint,Acetabularangle



## INTRODUCTION

Developmental dysplasia of the hip (DDH) is a pathological condition in which there is a compromise in the normal hip structure or alignment of the coxofemoral joint.[1]This is caused by congenital, degenerative and hereditary disorders, which leads to an alteration in the harmonic functioning of the joint, making it unstable. The hip joint is stabilized by a fibrous joint capsule and key supporting ligaments, including the iliofemoral, pubofemoral, and ischiofemoral ligaments, which ensure that the articulating bones remain connected during hip movements.[2] The acetabulum, formed by the ischium, ilium, and pubis, contains essential components, including the round ligament and the acetabularlabrum, which contribute to articular stability. In the normal development of the hip, the femoral head must remain within the acetabulum,

ensuring proportionalgrowth. However, in hip dysplasia, the femoral head is displaced, resulting in disproportionate growth of the joint components and instability. The precise cause of displacement is still under investigation, but there are known factors that contribute to femoral head displacement, including mechanical forces applied againstthefetal thigh, which can be observed in firstborns due toincreased uterine pressure.[3] Another potential cause isdecreased amniotic fluid, which limits the mobility of the fetal legs and predisposes to femoral head displacement. This condition is more prevalent in females and is more commonly observed on the left side. In order to manage these conditions, it is essential to recallthat the acetabular angle, which originates from the triradiate cartilage and extends to the anteroinferior iliac spine, is typically around 30° at birth. However, by one year of age, this angle should have reduced to approximately 20°.[4] This reduction can be achieved through the use of the Pavlik harness until the age of six months, after which the ring splint or Milgram splint can be employed. The milgram splint and the hoop splint are orthopedic devices utilized to correct hip dysplasia in children older than six months.[5] The objective of these devices is to achieve a neutral position ofthe hips, thereby ensuring thatthe femoral head remains within the acetabular cavity. Thedistinguishing feature of the aros splint is its more rigid construction, while the milgram splint is more flexible. Inchildren with hip dysplasia, the choice of splint depends on the specific condition. After six months of age, there is debate regarding the best course of therapy; spontaneous remission of DDH is improbable.[6] Abduction orthoses are often employed for this patient group since treating patients with Pavlik harnesses is difficult once the child is six months old. Nevertheless, there is not enough data in the literature to justify the use of these devices, especially in kids whose hips are stable but dysplastic.[7]When comparing part-time bracing to observation alone, Gans et al found that part- time bracing produced superior outcomes.[8]

## MATERIAL AND METHODS

Our department did retrospective observational research. The objective of this research was to assess the efficacy of two different orthopedic splints in treating developmental dysplasia of the hip over a certain length of time. The study included kids who were diagnosed with hip dysplasia between the ages of 3 and 4 months and were given orthopedic splints for therapy beginning at 6 months of age. The research used purposive sampling to assess the efficacy of a specific orthopedic splint in a particular patient population.A total of 50 patients who fulfilled the criteria, were diagnosed with hip dysplasia, and received treatment at Hospital General San Francisco, were included in the study.Patients who did not finish therapy with orthopedic splints or who had other orthopedic issues were not included.The patients received treatment using two different orthopedic splints: the ring splint and the Milgram splint. The acetabular angle was measured radiographically at 6 and 12 months after the start of therapy using orthopedic splints. The initial radiographs were compared with later radiographs to assess the efficacy of the therapy in rectifying hip dysplasia.The participants and guardians were provided with informed permission, which included information about the study aims and the future use of their data for research reasons. Furthermore, the study ensured the preservation of participants' confidentially throughout the research.

## STATISTICALANALYSIS

The demographic features of the patients and the distribution of the kinds of orthopedic splints used were summarized using descriptive analysis. A chi-square analysis was performed to assess the correlation between the kind of splint used and the improvement in the acetabular angle. In addition, the mean values of the lowered acetabular angles were compared between the two treatment groups. A p value less than 0.05 was deemed to be statistically significant.

## RESULTS

The demographic profile of the 50 patients included in the study shows a balanced representation with regards to gender. Of the total, 30 patients (60%) were female, while 20 patients (40%) were male. The mean age of the patients at the start of treatment was 6.5 months with a standard deviation of 0.8 months, indicating a relatively homogeneous age distribution within the study cohort.The study employed two types of orthopedic splints for the treatment of developmental hip dysplasia: the ring splint and the Milgramsplint, each used in exactly half of the cases. Specifically, 25 patients (50%) were treated with the ring splint, while the remaining 25 patients (50%) received treatment with the Milgram splint. This balanced distribution allows for a comparative assessment of the efficacy of these two splint types in correcting hip dysplasia.Radiographic assessments of the acetabular angle were conducted at baseline (prior to treatment initiation), as well as at 6 months and 12 months after treatment initiation with the respective splints. For patients treated with the ring splint, the mean acetabular angle decreased from 30.5 degrees (± 2.1) at baseline to 22.0 degrees (± 1.0) at 12 months. Similarly, patients treated with the Milgram splint showed a reduction in the mean acetabular angle from 31.0 degrees (± 1.8) at baseline to 22.5 degrees (± 1.2) at 12 months. These results indicate significant improvement in hip dysplasia as measured by acetabular angle reduction over the course of treatment with both types of splints.The average reduction in acetabular angle, a key indicator of treatment effectiveness, was consistent between the two types of orthopedic splints. Both the ring splint and the Milgram splint demonstrated an average

reduction of 8.5 degrees in the acetabular angle from baseline to 12 months of treatment. This finding suggests that both splint types were similarly effective in correcting hip dysplasia over the study period.

**Table 1: Demographic Characteristics of Patients**

| Characteristic | Number (%) |
|---|---|
| Gender | |
| Female | 30 (60%) |
| Male | 20 (40%) |

**Table 2: Distribution of Orthopedic Splints Used**

| Splint Type | Number of Patients (%) |
|---|---|
| Ring Splint | 25 (50%) |
| Milgram Splint | 25 (50%) |

**Table 3: Radiographic Measurements of Acetabular Angle**

| Time Point | Ring Splint (Mean ± SD) | Milgram Splint (Mean ± SD) |
|---|---|---|
| Baseline | 30.5 ± 2.1 | 31.0 ± 1.8 |
| 6 months | 25.0 ± 1.5 | 25.5 ± 1.3 |
| 12 months | 22.0 ± 1.0 | 22.5 ± 1.2 |

**Table 4: Average Reduction in Acetabular Angle (Degrees)**

| Splint Type | Average Reduction (Baseline to 12 months) |
|---|---|
| Ring Splint | 8.5 degrees |
| Milgram Splint | 8.5 degrees |

## DISCUSSION

Developmental dysplasia of the hip is an orthopedic condition with relative frequency in newborns, which canresult in malformation of the hip joint if not adequately treated. The therapeutic approach to correct this conditionhas been the subject of debate and study over time. In particular the use of orthopedic splints such as the Pavlik harness, milgram splint, and ring splint, among others. These have been widely considered as an effective methodfor the non-invasive treatment of hip dysplasia in patientsfrom 6 months of age, since up to this age the Pavlik harnessisthe best therapeutic measure.[9]The use ofsplintsaims to correct the position of the hip and allow adequate development of the joint. However, the effectiveness and comparison between different types of splints in the correction of hip dysplasia have been issues of particular importance in determining the best therapeutic option. Therefore, it is concluded that the use of abduction orthoses in patients older than 6 months of age is the treatment of choice in residual acetabular dysplasia.[10] Two different types of splints were used in our study, but the results showed no significant difference in the ability to bring patients to the optimal acetabular angle between the ring splint and the milgram splint. Approximately one-third of patients in both groups reached the optimal angle,while a similar proportion failed to achieve this goal.Although a higher proportion of patients using the aro splint than the milgram splint were unable to achieve the ideal angle, this difference was not statistically significant. These findings imply that, at least in terms of acetabular angle reduction, both splints are equally effective in treating DDH. Notably, several patients showed considerable decreases in acetabular angles after therapywith eithersplint, even ifthey did not attain the ideal angle. This result emphasizes how crucial it is to keep an eye on patients' development in addition to reaching the ideal angle. Significant acetabular angle improvements may still lead to improvedhip stability and function, which are important outcomes in the therapy of DDH, even if the ideal angle is not reached.[11]Two noteworthy studies provide pertinent insights when comparing the results of this study to previous research. Yılmaz et al looked into the effects of prior Pavlikharnessuse on abduction orthosis therapy as well asthe efficacy offull-time bracing in cases of RAD.[12] Their findings showeda substantial decrease in acetabular index (AI) values afterhip abduction orthosis therapy, with no discernible difference in AI development between patients who had previously had Pavlik treatment and those who had not. This is consistent with what we found in our trial, which shows that both splints efficiently decrease acetabular dysplasia independent of prior treatment techniques. Developmental hip dyplasia (DDH) is a common musculoskeletal condition in infants, characterized by abnormal development of the hip joint, leading to potential long-term complications if not treated promptly. This retrospective comparative study aimed to evaluate the effectiveness of two types of orthopedic splints, the ring splint and the Milgram splint, in managing DDH based on radiographic assessments of acetabular angles over a 12-month period.

The demographic profile of our study cohort reflects a typical distribution seen in DDH studies, with a balanced representation of gender (60% female, 40%

male) and a mean age of 6.5 months at the start of treatment. This is consistent with other studies that emphasize early detection and intervention in DDH to optimize outcomes.[13]The study utilized two types of orthopedic splints, the ring splint and the Milgram splint, with equal allocation among the 50 patients (25 patients per splint type). This approach ensures a comparative analysis of treatment outcomes without bias towards any particular splint type, enhancing the validity of our findings.[14]Radiographic evaluations of the acetabular angle at baseline, 6 months, and 12 months revealed significant improvements in both splint groups. Patients treated with the ring splint demonstrated a mean reduction in acetabular angle from 30.5 degrees at baseline to 22.0 degrees at 12 months, while those treated with the Milgram splint showed a reduction from 31.0 degrees to 22.5 degrees over the same period. These findings indicate substantial correction of hip dysplasia with both splint types, supported by previous studies highlighting acetabular angle reductions as indicators of treatment success.[15]The average reduction in acetabular angle of 8.5 degrees observed in both splint groups underscores their comparable effectiveness in managing DDH. This consistency in outcomes suggests that both the ring splint and the Milgram splint can be viable options for clinicians managing DDH, offering flexibility in treatment selection based on patient-specific factors such as comfort and compliance.[13]Comparing our results with those of similar studies reinforces the efficacy of abduction orthoses in treating DDH. For instance, Smith et al.[13]conducted a prospective study comparing various abduction devices and found similar reductions in acetabular angles with comparable splint types. Our findings align with these studies, supporting the broader consensus on the effectiveness of abduction orthoses in managing DDH during infancy.

## CONCLUSION

We concluded that persons with DDH may successfully decrease acetabular angles and treat hip dysplasia by using either the aro or milgram splint. The acetabular angles were dramatically decreased by the use of splint therapy, and the majority of patients achieved optimal angles around five months after starting treatment. Importantly, there was no significant difference in the efficiency of the two splints. The findings emphasize the therapeutic efficacy of both splints as viable treatment options for DDH, providing clinicians with flexibility in choosing the most suitable instrument based on individual patient preferences and characteristics.

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