



# HIP DYSPLASIA AND HYPOTONIA

## CAN STANDING IN ABDUCTION HELP?

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Standing with hips in abduction has evolved as the new standard treatment to maintain hip integrity in children with developmental delays and increased muscle tone, particularly those with GMFCS levels IV and V. When children are monitored using hip X-rays, doctors are watching for hip dysplasia, hip subluxation or hip dislocation. Hip dysplasia is the medical term for a hip socket that doesn't fully cover the ball portion of the femur. This allows the hip joint to become partially or completely dislocated. For parents, this means doctors are watching to see if the femoral head, or ball of the femur, is snugly positioned within the developing socket. Subluxation is the beginning of hip integrity problems and is defined as the head of the femur beginning to migrate or move out of the socket more than 33 percent. If the head of the femur moves completely out of the socket, the hip is then considered dislocated. Hip dislocations can be painful for children, and surgeries are not always successful in maintaining the position of the hip. Research in Sweden showed standing, as part of an overall posture management program for children with cerebral palsy, has led to prevention of hip dislocations (Hagglund, 2014). Smaller sample size studies are promising as they measured children who maintained their hip abduction range of motion, and even have potential to improve their hip migration percentages, by standing for an hour a day in an abducted position (Macias 2015 and Martinsson 2011).

Less evidence exists for the impact of standing on hip integrity for children with low muscle tone. The following is a case study of a young boy with low muscle tone and right hip dysplasia. Bode is a 4-year-old boy with Emanuel syndrome, a chromosomal disorder that is characterized by hypotonia, developmental delays and failure to thrive during infancy. Bode came home from the hospital after birth with a G-tube, but he was eventually able to learn to drink from a bottle and was able to take his full nutritional needs orally by 5 to 6 months of age. About that same time, Bode was referred for evaluation of his hips due to concerns about dysplasia. Bode underwent ultrasound of his hips in May 2015 (see Table 1 for measurements) and continued to be followed at regular intervals for a year, decreasing to 6- to 12- month rechecks after that time.

**5 MONTHS:** Bode was diagnosed with hip dysplasia at age 5 months. Beginning with his hip dysplasia diagnosis, Bode began wearing a Pavlik harness 24 hours a

day for a two month period (see Figure 1). At this stage in his development, Bode was slow to meet any motor milestones. He had secondary torticollis due to lower tone and strength and overall was slow to gain head and trunk control secondary to hypotonia. On a positive note, Bode was drinking from a bottle and no longer using his G-tube. He was not able to get his hands up to pat his bottle, and he had difficulty sustaining grasp on small rattles. The Pavlik splint kept Bode on his back, and it was challenging to find ways to help Bode get stronger and prevent flattening of his head.

**7 MONTHS:** After Two months of wearing the Pavlik harness, Bode showed some progress in his alpha measurements (see Table 1), however, Shenton's Line was still disrupted on imaging. Shenton's Line is another sign of dysplasia. Shenton's line is an imaginary curved line drawn along the inferior border of the superior pubic ramus (superior border of the obturator foramen) and along the inferomedial border of the neck of femur (see Figure 2). This line should be continuous and smooth. At this appointment, Bode was able to move to a hip abduction splint with 18 hours of wearing time daily (see Figure 3). This splint opened up the possibility of working on sitting upright, challenging head and trunk control, and movement on the floor



**TABLE 1: HIP ULTRASOUND ALPHA ANGLE MEASUREMENT**

Dates	Right	Left	Notes
05/02/15 (5 months)	50 degrees	70 degrees	
07/01/15 (7 months)	56 degrees	69 degrees	

\*normal alpha value = 60 degrees or greater

during the hours he was out of the splint. While Bode could still kick his legs in the Pavlik harness, he had difficulty using his legs to move against gravity when not in a splint.

**9 MONTHS:** Bode was now getting X-rays rather than ultrasound measurements as he was older; as the hips begin to ossify, the use of ultrasound for measurements becomes difficult, so typically children will move to X-ray images for diagnostics. His acetabular angle measurements were at the high end of the normal range (see Table 2). Bode was able to begin use of a stander with hip abduction and he was fitted for a Zing multi-positional stander. Bode continued with the night hip abduction splint with a wearing time of 12 hours. The initial goal for standing was to see if this intervention would improve his hip dysplasia, using imaging studies as a measure. We hoped

to get Bode to stand for 45 minutes twice daily while playing with simple toys or watching a favorite music show. 90 minutes a day meets the criteria recommended for children with higher tone to help maintain hip integrity (Paley, 2013).

Bode tolerated his stander right away. He initially stood in slight supine (5 to 10 degrees) to help him keep his head and trunk upright and prevent fatigue. He was able to progress to 45 minutes very quickly and was able to meet the 90 minute duration we had hoped for. He was also able to progress to 30 degrees of abduction bilaterally. This took a period of four to six weeks as his hip extension range of motion was limited from being in a Pavlik splint and hip abduction splint for three to four months, both of which had positioned him in hip flexion. At this point in his development, Bode was not able to move on the floor independently for mobility, and he was still not able to sit upright by himself but he could sit with support to play with simple cause and effect toys. Bode was unable to bear any weight on his legs in a supported standing position without the stander. As Bode progressed with standing in his stander, we began to bring him upright and into prone for short periods of time, playing in a

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working position to build strength and endurance (see Figures 4-6).

**12 MONTHS:** At his December follow-up; Bode was ready for AFOs and standing with support at furniture. Bode was now able to stand in 15 degrees of prone position for 90 minutes of standing and playing. While his imaging measurements did not change significantly (see Table 2), his Shenton Lines were intact bilaterally, a positive sign he was moving in the right direction. Bode's strength also improved by leaps and bounds. By working in prone every day in his stander, Bode was now using his arms to push himself over and roll while on the floor. He was sitting upright with less support. He was also beginning to hold his own bottle and was starting to finger feed himself.

**18 MONTHS:** This follow-up appointment showed some good changes in that his hips were beginning to ossify. His doctors had been concerned that he was not showing bone formation on earlier reports, and evidence of increased ossification was a good sign that standing and weight bearing were improving his bone density. Bode's hip measurement numbers were unfortunately moving in the wrong direction (see Table 2) and Shenton's Line was disrupted on the right side again. Bode was continuing to use his stander on a regular basis, standing 90 minutes a day most days, however he was not wearing his night time hip splint any more. Earlier in the year, Bode had been hospitalized for four days due to high fevers and dehydration. His parents shared that during his hospitalization, Bode did not wear his hip brace, and they were unable to get him back into a routine

of wearing it without him waking up at night. It's possible that his inability to wear his night splint for most of this six-month period contributed to the changes noted on the hip X-rays. This was the end of him wearing a night brace, which made his stander more important than ever in providing some weight bearing in an abducted position. At this point, I revisited the angle of his stander, having him stand fully upright to get the most weight bearing on his hips for ossification. Developmentally, Bode had progressed in strength over the last six months. He was standing at the couch for 10 to 15 minutes to play with toys now, though he could not pull himself up or grasp onto toys tightly. Bode was working on standing, holding onto a gait trainer to develop grasp strength and standing balance.

**24 MONTHS:** This follow-up showed more progression of his acetabular angle in the wrong direction, indicating increased hip dysplasia (see Table 2). Bode was continuing to stand in his stander, closer to 60 minutes rather than 90 minutes a day, by his second birthday. Standing in his stander alone was not enough to keep his hips stable. Bode was also beginning to walk in his gait trainer with adult assistance 50 to 100 feet at home or in the education building at the center. At home, he walked from room to room with 2 hands held if the walker wasn't close by. While walking, Bode did show decreased strength, and he often would adduct his legs across midline due to poor hip abduction and hip extension strength. Therapist facilitation helped decrease this pattern over time, but he usually presented with some adduction or mild scissoring while walking longer distances. Bode was now able to sit by himself while playing. Throughout his day, we tried to implement more strategies for sitting and playing with an abducted/externally rotated posture of his hips. Bode also got a new high chair that facilitated sitting with better posture and placed his legs in abduction.

**34 MONTHS:** It had been a long time between appointments, and Bode's parents were nervous about his imaging results. Both hips showed mild progression of dysplasia (see Table 2), and Shenton's Line was disrupted bilaterally but images were starting to show more ossification in both hips. Overall his physician was pleased and planned to continue to monitor his progress. Bode was beginning to use soft twister straps under his clothes, attached to his AFOs, to keep his legs aligned in neutral or outward rotation while sitting and playing. Bode often sat in a long sitting posture playing independently, but his legs would rotate internally at the hips after several minutes. Use of soft twistlers allowed him to move in and out of sitting without the bulkiness of a hard twister cable. Twister straps seemed to be helping, and they were well-tolerated; hopefully, this would slow his hip progression.

**3 YEARS, 4 MONTHS:** Physician notes from this visit referred to his migration percentage. While only 10 percent MP, the goal was to keep the hips stable and prevent surgery. Bode was now attending preschool and walking with a gait trainer with forearm prompts (he never gained enough grasp strength for holding handles). He could walk 400 to 500 feet around school with guidance. He had learned how to get into sitting independently, but unfortunately this was done



TABLE 2: ACETABULAR ANGLE

Dates	Right	Left	Notes
09/02/15 (9 mo)	28	24	Shenton's line disrupted on right side
12/07/15 (12 mo)	27	23	Shenton's line intact bilaterally
06/23/16 (18 mo)	30	26	Mildly disrupted shenton's line on right, intact shenton's line on left side
12/22/16 (2 years)	30-32	24	Shenton's line mod -severe break on R Shenton's line Mild break on L
10/06/17 (34 mo)	32	27	Shentons's line interrupted bilaterally.
04/12/18 (3 + 4 mo)	10% MP	10% MP	(Physician notes referred only to migration percentages after age 3) physician noted stable dysplastic appearance of R acetabulum
10/03/18 (3 + 10 mo)	15% MP	10% MP	

\*normal acetabular value = 28 degrees or less

\* MP = migration percentage

through a W-sitting position by Bode pushing up with his arms. He needed help to correct his W-sitting posture once he sat up. Bode was trying to crawl on hands and knees using his head as a fifth support surface. Bode was continuing to gain nice strength and motor skills, but he was sitting in positions that were not ideal for his hips.

**3 YEARS, 10 MONTHS:** Bode continues to show progression of his right hip dysplasia, now at 15 percent MP. Since beginning school, using his stander at home is harder to accomplish on a daily 60 minute basis. Bode continues to walk with adult guidance in his gait trainer, and he still is very much dependent on adults to help with transitions in and out of gait trainers and chairs. He uses a small stander at school while playing at the sensory table to keep him safe while standing around other active children.

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**SUMMARY:** After following Bode's case so closely for four years, I can't say we have hard evidence demonstrating standing can help improve hip dysplasia for those with hypotonia. I do believe the stander helped him gain strength and motor skills. I also believe the consistency and duration of standing declined as he was older and entered school. This is a family committed to helping their son in every way possible but caring for a child with special needs requiring constant adult help becomes tiring and continuing home programs is hard in the best of circumstances. The measurable changes that occurred to his hips when he stopped wearing his night splint between 12 and 18 months supports the need for nighttime positioning but presents a real challenge when the child won't sleep with a night splint. Could the stander have

helped in ways we don't know? It is very possible that without standing Bode may have needed surgery by now. Research in children with higher muscle tone has shown that the younger a child is when needing their first hip surgery, the more likely they will be to need additional hip surgeries. Perhaps standing is delaying the need for surgery or, hopefully, he will not need surgery at all. This case review shows there is a need for more studies looking at younger children with hypotonia, hip integrity, and standing, so we can develop best practices in the future.

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Mary Miles has more than 30 years of experience as a pediatric physical therapist. She is currently working with children ages birth to 3 and their families in White Bear Lake schools. Miles has presented educational courses for Altimate Medical and written for different rehab publications over the years.

