

Splint for Treatment of Congenital Hip Disease*

FREDERIC W. ILFELD, M.D.

The early diagnosis of congenital hip disease has increased the number of cases recognized during infancy and before weight bearing. Statistical (1) studies show that the earlier the treatment, the better are the results, and that, abduction splinting is the best treatment in these early cases. Splinting may also be used after closed or open reduction of the hip to eliminate or to shorten the plaster cast time (1).

The abduction splint method of therapy is not new. It has been advocated by Bost (2), and Haas (3). Effective splints similar to the one described here have been devised by Ponsetti (4), Denis-Browne (5), Frejka (6), and others.

Rationale of Splint

Since October 1951 a splint (fig. 1) with two thigh cuffs connected to an adjustable bar has been used in about 250 cases of congenital hip disease with good results. With this splint the thighs are gradually and without force directed into abduction and external rotation, the "frog position." The surgeon adjusts the splint into further abduction at weekly intervals until the desired position is obtained. The splint is removed several times a day by the mother for rotation-abduction exercise. This exercise as well as the kicking and natural movement of the hips in the splint tend to improve local circulation, increase abduction, and apply gentle pressure of the femoral head against the acetabulum.

In the frog position the thigh muscles exert a force along the femoral shaft "pulling" the head into the acetabulum. In this way the dislocation of the femoral head is reduced. In dysplasia of the hip with delay in the development of the femoral head and acetabulum, the pressure of the femoral head in the abducted position is thought to stimulate bony growth. In dysplasia the splint is usually worn only at night. In dislocation the splint is worn continuously for several months being removed daily for bathing and exercise. The splint is then worn only at night until hip development is complete.

Construction of Splint

The splint consists of two thigh bands (fig. 2 B and fig. 3 [1]) made of $\frac{1}{2}$ hard aluminum thickness .064 with Indiantone cloth covers and buckle straps. The thigh bands are connected by a special swivel (fig. 3 [2], an aluminum ball 24 ST $\frac{5}{8}$ inch diameter, with a washer (fig. 3 [4]) 24 ST aluminum $\frac{5}{8}$ inch diameter $\frac{1}{4}$ inch hole and a knurled cap screw (fig. 3 [5]) $\frac{1}{4}$ - 28, $\frac{3}{4}$ inch long. The swivel allows accurate fitting of the thigh band and is tightened with an hexagonal wrench which the surgeon keeps to prevent home adjustment. The swivel is attached to the cross piece (fig. 2 A) by a hinge joint (fig. 2 C). The male part of the hinge joint (fig. 3 [3]) is made of $\frac{1}{8}$ inch cold rolled plate. The rivet pin (fig. 3 [6]) through the hinge is $\frac{3}{16}$ inch diameter. The female part of the hinge (fig. [7]) is part of the cross piece (fig. 3 [9] and [10]). The hinge moves

* This study received aid from the Bloomfield Foundation. The author also wants to thank Hy. M. Christensen, C.O. of the Ace Orthopedic Company for his help.

Dr. Ilfeld was born in 1907 in Los Vegas, New Mexico. He received his A.B. Degree from Harvard College in 1928, and graduated from the Harvard Medical School in 1932. Dr. Ilfeld received his hospital training at Peter Bent Brigham Hospital in Boston and the Lakeside Hospital in Cleveland. Special orthopedic training was received at the Children's Hospital and the Massachusetts General Hospital in Boston. In World War II he served five and a half years with the Army Medical Corps as an orthopedic surgeon. Currently Dr. Ilfeld is practicing in Beverly Hills, California and serving as Assistant Professor of Orthopedic Surgery at the University of Southern California Medical School. He is a member of the staff of the Children's Hospital, the Cedars of Lebanon Hospital, St. John's Hospital, Mt. Sinai Hospital and the Los Angeles County General Hospital.



FREDERIC W. ILFELD, M.D.

through 90 degrees. This allows the cross piece to be comfortably placed in the sitting or lying position. In the supine position the cross piece points toward the feet, in sitting it points upward and so is out of the way. A common error in applying the splint is to have the hinge point posteriorly instead of anteriorly. The holes in the cross piece are spaced $\frac{5}{8}$ of an inch apart for adjustment of growth and abduction. They are tapped with 8/32 thread for a round head machine screw $\frac{1}{4}$ inch long 32 thread. The cross bar is made of cold rolled steel $\frac{1}{8}$ x $\frac{5}{8}$ inch.

The splint is made to fit the patient (fig. 4) with allowance for growth. It is commercially available in five sizes: size one for a baby 2-4 weeks of age; size two 4-12 weeks; size three 3-8 months; size four 8-24 months; size five 2-4 years. Shoulder straps or pelvic girdle may be used to help keep the splint in place.

When splinting is used in older children 2 to 10 years of age, the thigh cuffs are made of larger and heavier material. In place of the hexagonal swivel, the cuffs are adjusted by means of a swivel plate with holes, a bolt, and winged nut. The crosspiece is heavier and made of aluminum. In older children a pelvic girdle with elastic straps extends down to hold the splint in position.

For internal rotation of the hip (fig. 5), the thighs are held fixed in slight abduction and outward pressure is applied against the shin or lower leg. This maneuver internally rotates the hip. The position is maintained by using an adjustable "out-rigger" attached to the cross piece and fastened onto the lower leg by a cuff and swivel with hexagonal screw. In these cases the 90 degree hinges of the cross piece are eliminated or soldered solid. Even in this position of internal rotation the child can crawl and walk.



Fig. 1. at right—
The splint consists of two thigh cuffs
connected with an adjustable cross
bar controlling abduction. The bar
points upwards for sitting and down-
ward for the lying position.

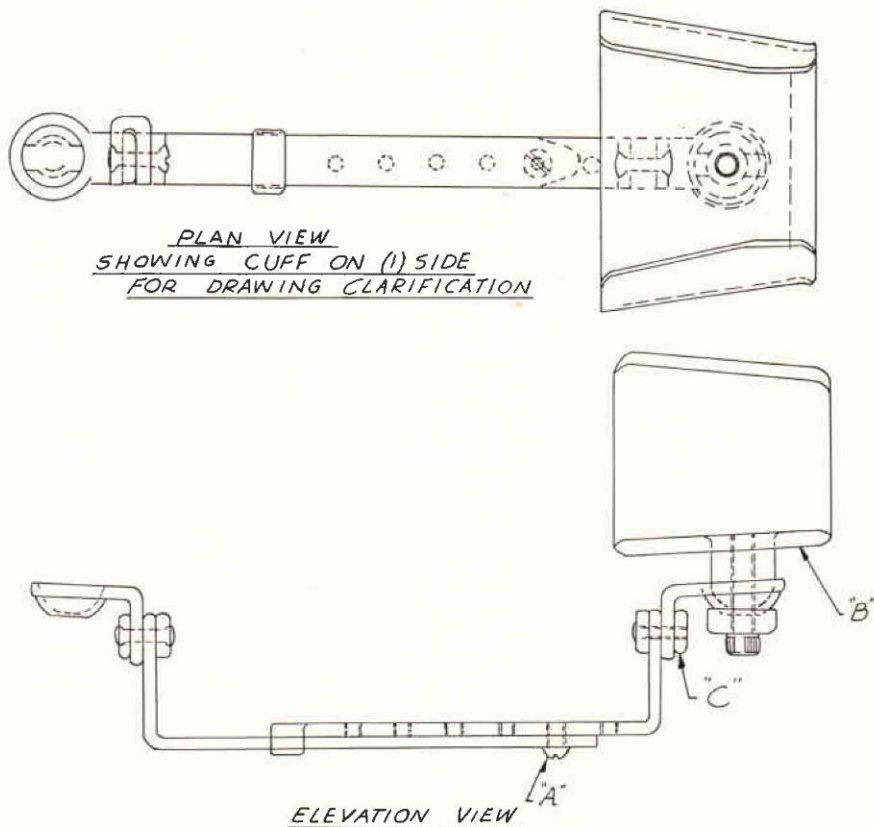


Fig. 2. Ilfeld Splint.

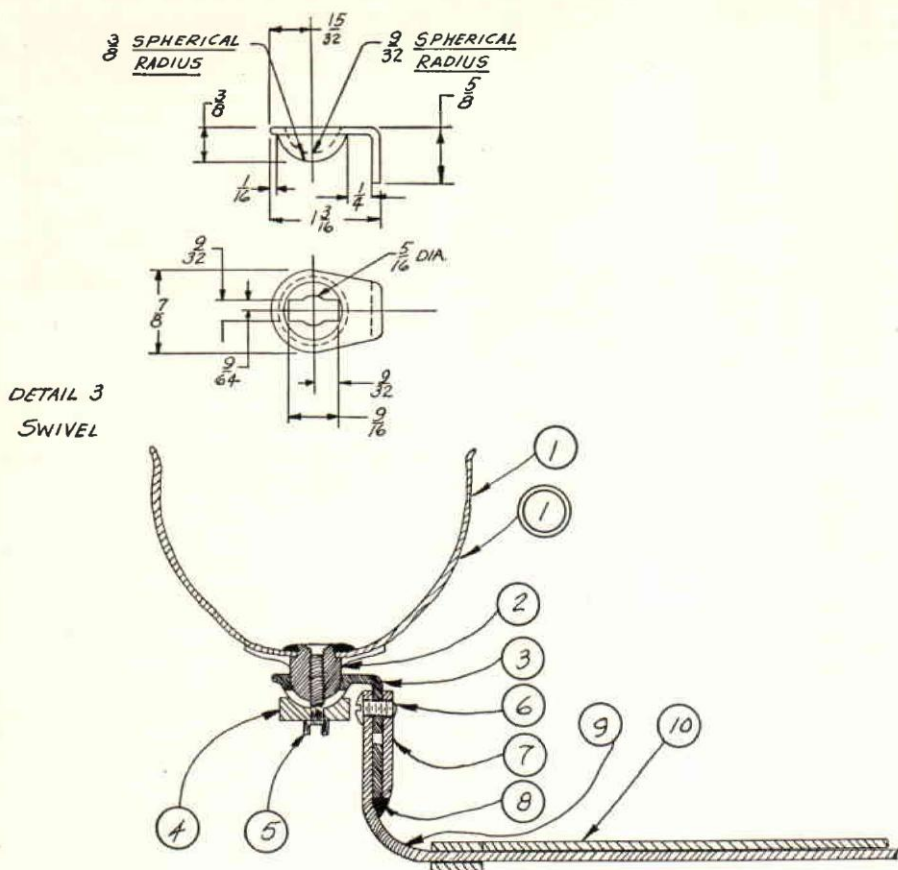


FIG. 3—Detailed drawing of abduction splint

Conclusion

Splinting in infants will usually reduce a dislocation of the hip without anesthesia, hospitalization, or plaster cast. In older children it may be used after closed or open reduction, even without preliminary plaster fixation. In some cases the splint may replace the cast after 4-6 weeks thus eliminating many months of plaster immobilization.

The splint method is dynamic, permitting crawling, walking, and running. It is adjustable for growth, cool and comfortable, light and handy. This method of treatment prevents stiffness of the hips and knees, stimulates acetabular and femoral growth, is convenient for the mother, and allows mobility of the child.

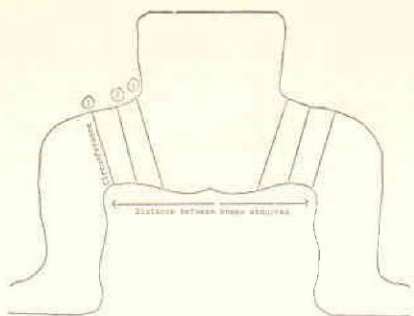


Fig. 4. Measurements for construction of splint. The arrows above indicate distance between knees abducted. Line 1 at left: circumference.

1. Lay child flat or supine for measuring or tracing.
2. Give age of child—hip condition—and stipulate which hip is affected.
3. Be sure to record the circumference of both legs in the three designated places.

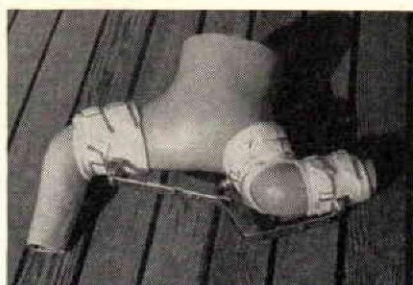


Fig. 5. Model of the internal rotation splint. An "outrigger" extends from the cross bar to the shin regulating internal rotation. The ninety-degree hinges are omitted or soldered solid.

Bibliography

1. Ilfeld, Frederic W.: The Management of Congenital Dislocation and Dysplasia of the Hip by Means of a Special Splint, *J. Bone and Joint Surg.* Vol. 39-A p. 99, Jan. 1957.
2. Bost, F. C.; Hagey, Helen; Schottstaedt, E. R.; and Larsen, J. L.; The Results of Treatment of Congenital Dislocation of the Hip in Infancy, *J. Bone and Joint Surg.*, 30-A: 454, Apr. 1948.
3. Haas, Julius: Congenital Dislocation of the Hip, ;: 198-199. Springfield, Illinois, Charles C. Thomas, 1951.
4. Ponseti, Ignacia: Cause of Failure in the Treatment of Congenital Dislocation of the Hip. *J. Bone and Joint Surg.*, 26: 775, Oct. 1944.
5. Denis-Browne: Congenital Dislocation of Hip Splint, *J. Bone and Joint Surg.*, 37-A; p. 4, 1955.
6. Frejka, M. B.: Treatment of Congenital Dislocation of the Hip. Unpublished paper presented at the Annual Meeting of the American Academy of Orthopaedic Surgeons, Chicago, Illinois, Jan. 1947.