Birth Defects Bracing— Why, When and How Much

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As you are probably aware, the word *Orthopedic* is derived from two Greek words, the combination of which means *straight child.* Nowhere is this derivation more appropriate than in the bracing of the child with birth defects. Among the laity, the designation as an orthopedist is frequently misunderstood, mispronounced, and confused with other specialties or even non-medical occupations. However, it *is* easier to say than orthotics and prosthetics, so maybe there is hope for us. I'll never forget an amputee whom I examined for evaluation of alleged total disability. It was on a hot summer day, and eight of the ten chairs in my air-conditioned waiting room were occupied by the man, his wife, and their six small children. He arrived on crutches with one pants leg appropriately folded up and pinned, so my first question was: "Don't you use a prosthesis?" He bristled and said, "Certainly not! We're Catholic."

Those of you who remember the early Model T Fords will recall that the only way to start them was by cranking, and so that one person could do the job, the choke had an extension on a little ring at the front of the car so that the usually sweating and swearing cranker could also choke—which he sometimes did. Then *progress* came along with the battery- powered starter, and the choke got moved inside. This was fine as long as everything worked smoothly, but on the not-infrequent occasions when it became necessary to crank, someone had to sit in the car to man the controls. My father was a powerful man—he had powerful muscles, a powerful sense of justice, and a powerful temper. As he would crank, it was my mother's hazardous duty to manipulate the choke. If the motor wouldn't start—or even worse, if it started briefly then died—dad would straighten up and shout in a volume indicating he assumed mother was in the trunk and stone deaf, "Did you choke it?" He really should have been a lawyer. At this point, he had her trapped. If the answer was "No" he would ask, "Well, why didn't you?" If the answer was "Yes" he would say, "Well no wonder! You choked it too much." This was my introduction to the "team approach."

INCIDENCE, AND GOALS OF TREATMENT

Today, the problem is even more complex. Cars are provided with neither a crank nor a controllable choke, so if the family bus doesn't start, you have to call a specialist. Up until the advent of early meningomyelocele repair which was pioneered by Doctor M. P. Sayers of Columbus in 1954, the treatment of children with birth defects was in the Model T era. With

the development in 1956 of the Holter valve for ventriculo-jugular shunts to prevent hydrocephalus, we have moved into the modern age of such treatment, with complexities demanding the team-of-specialists approach. As with any team, communication among all team members is essential, not only in defining our goal, but also in determining the "plays" that we hope will lead us in that direction. In this regard, we should never lose sight of the fact that the most important members of the team are the patient and his family. Too often we tend to set goals and because we are too busy, too erudite to converse in lay language, or too impatient to repeat, we do not communicate what we are trying to accomplish.

Not only the doctors, orthotists, and therapists, but *ALL* persons associated with *ANY* phase of the care of a child with birth defects should be oriented and re-oriented as often as necessary to make sure everyone knows what to do and why. This includes not only the parents, but also the grandparents, baby-sitters, etc. A brace applied only to maintain correction of club feet may be completely successful. But it is a disappointing, dismal failure if through our errors of omission the parents have expected this brace to make the child walk.

The problem of care and bracing of children with birth defects is a growing one. There are 250,000 such children born annually in the United States. Of these, 60% involve the musculoskeletal system either directly, or indirectly through the nervous system. This means that each year there are 150,000 new patients who are potentially in need of bracing. I say the problem is growing for two reasons: So far, the prevention of birth defects had been pretty much incidental to improving prenatal maternal health. The factors which may have a role in the production of birth defects, such as trauma and exposure to radiation and toxins, are on the increase. Improved obstetrical care reduces the likelihood of a miscarriage which may be nature's way of aborting an abnormal baby. So we may actually see an increase in the number of live births producing children with these defects. Coupled with this is the reduction in mortality rate in these children. Formerly, many such children died in early life of infection, hydrocephalus, or later complications in other organs such as the urinary system. Repair of the defects, shunting, urological procedures, antibiotics, etc., are keeping increasing numbers of such patients around for longer and longer times.

BRACING PROBLEMS

I shall confine my remarks this afternoon to bracing of the trunk and lower extremities. The birth defects child presents some bracing problems peculiar to this disorder, as contrasted to other forms of paralysis such as we see in polio, cerebral palsy, and trauma. In polio and cerebral palsy, we are dealing with motor abnormalities only. With trauma, we deal with motor and sensory problems, but we are usually working with a proportionate body, a normal mentality, and normal upper extremities. By contrast, bracing of the child with a meningomyelocoele must consider the combination of motor, sensory, trophic, and mechanical factors. The motor problems are principally those of flaccidity and un-opposed muscle pull. These factors may give rise to early or late complications such as scoliosis, hip dislocation, and club feet. True spasticity is rare, but unfortunately rigidity and contracture are not. This makes either conservative or even surgical correction of some deformities very difficult, as manipulation frequently produces a compensatory deformity rather than correcting one. For example, we have all seen attempts to force a hip into extension in a brace, produce a deforming increase in the lumbar lordosis intsead. Like-

wise, bringing a femur from an abducted position to the vertical line may do so only by the production of a tilted pelvis and scoliosis. Lack of bowel and bladder control presents hygiene problems in braces about the pelvis. Sensory loss makes the development of pressure sores an ever-present danger. Trophic disturbance and the attendant bone softening frequently cause pathological fractures when an otherwise innocuous force is applied to a deformed limb. Since this usually occurs in an anesthetic limb and the patient therefore does not offer protestations of pain, the parents should be advised of this possibility so that prompt treatment can avoid further deformity. I say they should be *advised* rather than *warned*, since any indication that such a fracture is a catastrophy or a sign of parental brutality results in such a fear of passive exercise and brace application that the parents are likely to do neither properly. The local mechanical problems facing the orthopedist and the orthotist require some engineering ingenuity. One must not only avoid pressure on a gibbus at the site of the defect, but also must frequently support a collapsing trunk. Commonly a Bricker stoma or "rosebud" must be by-passed. Once adequate braces are on the patient, the use thereof may be complicated by hydrocephalus which causes a disproportionate head size and weight, impaired mental processes, and inability to use the upper extremities normally.

CLASSIFICATION OF BRACES

I have attempted to highlight the scope and problems of bracing the child with birth defects. To discuss the when, why, and how much, requires a classification of braces. I like to think of braces in one or more of four classes: Preventive, corrective, supportive, or functional. The earliest applied braces may fall into the preventive or corrective categories. These may be applied long before the child is ready to assume the vertical position. The *preventive brace* is of simple design, sometimes with no joints at all, and is used to prevent either the occurrence of a deformity or the recurrence of a deformity that has been previously corrected. Since they are easily applied, these uncomplicated braces, besides benefiting the patient, are very valuable training material for the parents who have a tendency to be terrified by the application of cold steel and impersonal leather to their infant. *Corrective braces* with cams, adjustable tension, or what not, can be applied during this same period of infancy. Here I think I should again interject communication with and instruction of the parents. Not only should the parents be thoroughly instructed in how and when to put on the braces, we should make sure they have simple tools such as a Phillips screwdriver and an Allen wrench. There is nothing more discouraging than to work hard to prevent or correct a deformity, only to discover later that you have been defeated by a loose screw which didn't seem worth the trip to the brace shop. The next type of brace is the *supportive brace* which can be applied anytime one would ordinarily otherwise expect the child to stand. This is usually between one and two years of age. This is probably the most neglected and most misunderstood phase of bracing. I am frequently asked: "Why are you putting these extensive braces on this child when he is too young to walk, and with all his troubles he may never walk?" In the first place, the supportive brace may embody elements of the preventive or corrective brace. Even if it does not, and even if the ultimate goal is not independent ambulation, there are still many benefits to be gained by having the child spend some time in the vertical position. Trunk support facilitates the development of more normal gastrointestinal, cardiovascular, and respiratory functions. The stress thus applied to the lower extremities

stimulates better bone structure and minimizes the osteoporosis of disuse. Getting into the vertical posision helps produce better eye coordination, balance, and hand skills. In this position, gravity assists rather than retards adequate urine drainage. Not the least of the benefits is the psychological effect on the child who now sees himself in the same position as the people around him, and is thus better able to relate and imitate. *Functional braces* may incorporate features of the preceeding three. They are applied after, or are a modification of the supportive brace. Here is where it becomes vitally important to establish a goal and let everyone know what that goal is. A new goal can be advanced after an old one has been attained with no sweat. However, if because of initial over-enthusiasm, one has to repeatedly lower his sights, this may well appear in the eyes of the parents as a discouraging failure. Obviously, an adequately braced child who needs the support of a standing table and who cannot stand by holding onto something with his hands is not yet ready to master functional braces in parallel bars or crutches. Parents who should be happy that their child can walk with braces and crutches may be very unhappy if they have belived the goal was ambulation with braces only or no assistive devices at all. In functional bracing of the trunk and lower extremities, adequate support should never be sacrificed for mobility. A good rule is to make the braces as extensive as necessary to achieve support, then permit as much mobility as is possible without compromising the former. As the child demonstrates that he no longer needs some part of the brace such as hip locks, corsets, or dorsal extensions, they can be removed. This proposition of early overbracing has some merits. Undesirable postures and habits are avoided. For example, there is no harm in a child with normal musculature crawling, since he will develop the wherewithal to assume the erect position and then a more acceptable efficient propulsion. However, a child who is going to have to depend on some supportive device may be quite resistive to such assistance and future treatment if because of underbracing he discovers the easier, faster way of getting from one place to another is by crawling or scooting. Again it is bad psychology for both the patient and parents to keep adding parts to an inadequate brace. Conversely, elimination of a part indicates progress and reward and thus encourages future enthusiasm and cooperation.

SUMMARY

We have a small terrier named Laddie whose entire existence of one year has been either in the confines of the house or on the end of a leash. Since his only canine companionship is an elderly male cocker who waddles into our yard at mealtime, Laddie gets quite excited about Victor's visits. In fact, he gets so excited we wonder if he may not be a bit queer. After the exchange of a few perfunctory sniffs, Victor with the wisdom of seniority, makes straight for Laddie's bowl of Pard. Laddie, with his ambivalent enthusiasm, continues his investigative sniffing. By the time he has confirmed that the rear end of Victor is male, the front end of Victor has consumed all the food. My remarks to you today have attempted to emulate the front end of Victor: concentrating on the basic principles and meat of the problem, and not being concerned with the possibly more glamorous and heroic aspects.

The when, why, and how much of birth defects bracing can be summed up: Brace early. Brace for prevention, correction, support, or function. Over-brace, then eliminate as indicated. Thank you.