The Nature of Contractures

by Justin Alexander, Ph.D.

When orthotic devices are supplied to a patient, it is generally in the hope that function can be enhanced. If this expectation is to be realized, joint mobility or range of motion should be within normal limits. Unfortunately, there are many patients where a significant deficit in freedom of movement occurs. It is essential to realize that the causative factor for such limitation is varied, so that one may develop a reasonable treatment approach.

Impedence to free motion can result from injury or malfunction of the skin overlying a joint, muscles or tendons surrounding or crossing joints, the joint capsule, or the joint surfaces. In many instances joint disturbances can be avoided by timely intervention such as correct positioning; active, assistive or passive exercises; or stretching and joint mobilization. Unfortunately, even when meticulous care is provided, limitations of movement can occur. Once tightness has been allowed to develop, it becomes more difficult and painful to restore normal function. A variety of mechanical devices designed to minimize the danger of developing contractures, or to overcome them, have been described in the literature. Surgical intervention may be attempted in carefully selected instances as well.

A common sequela to prolonged inactivity is loss of flexibility, probably due to shortening of muscle fibers and connective tissue. In an otherwise healthy individual this does not cause a serious problem and one can expect that with resumption of normal activity, muscles will regain length and flexibility. If, however, a limb is immobilized because of injury or disease, tissue repair involves replacement of muscle fibers with scar tissue which consist of collagen. Early, persistent, and careful physical therapy usually produces satisfactory restoration of movement.

Delay in starting therapy or placing the responsibility for performing a prescribed regimen completely on the patient or family member, without assurance that the program is understood and that it will be performed, is prone to produce serious impedence to normal mobility. It is important to note that when a distal joint is immobilized, the more proximal joints are not utilized as much as under ordinary conditions and secondary joint limitation may develop. Some common examples are the concommitant tightness of hip flexors and knee flexors, or the limitation seen in the shoulder and elbow of the patient who has sustained a Colles fracture of the wrist.

Immobilizing a part in a resting position does not necessarily produce limitation of movement, provided there is physiological rest.[1,2] On the other hand, if a part is immobilized and there is active muscle contraction to prevent the muscle from being elongated or the joint moved, muscle tightness can be invariably expected. When a person expects that motion might be painful, such as during the acute phase of Rheumatoid Arthritis or during severe and prolonged periods of ischemia, a "protective spasm" can be anticipated and frequently results in "irreversible contracture." The term "irreversible" must be used tentatively, since, if given enough time, the contracture may be relieved through ordinary activity.[3] In most instances, therapy cannot be provided or justified for the long period required to ameliorate the situation. In several instances, we have observed changes occuring over two years or longer following initial insult.

Extravasation of fluid into tissue surrounding the joint, such as may be observed following repeated trauma as a result of stretching which is performed too enthusiastically, or after episodes of bleeding in an individual with hemophilia, will invariably result in deposition of collagen and may continue to permit calcification of the capsule and end in heterotopic bone formation.

Heterotopic ossification presents a difficult problem to manage. While there have been some reports of spontaneous remission over time, others have reported recurrence after surgical excision.

Repeated insults to the integrity of the joint itself can lead to complete blockage of the joint, either as ankylosis of the capsule or due to fusion of the joint surfaces. Depending on which joint is involved, total or partial joint replacements have been very successful in restoring function and almost completely eliminating pain.

The management of the patient with contractures is complicated and if it is to be successful, close collaboration between physician, therapist, orthotist, and the patient and family is

imperative. In the presence of contracture, the application of an orthotic device can be wrought with danger. If too much tension is applied in order to gain motion when the patient is walking, protective spasms may counteract any stretching effect. It is also possible that excessive pressure can result in a fracture, especially if the patient has ben inactive for some time and if osteoporosis is present. The chances of successfully reducing joint limitations are increased when physical therapy and orthotic devices are combined in a comprehensive treatment program.

REFERENCES

[1] Harris, R. and Copp, E.P., "Immobilization of the Knee Joint in Rheumatoid Arthritis," *Ann. Rheum. Dis.*, 21:353, 1962.

[2] Partridge, R.E.H. and Duthie, J. Jr., "Controlled Trial of the Effect of Complete Immobilization of the Joints in Rheumatoid Arthritis," *Ann. Rheum. Dis.*, 22:91, 1963.

[3] Alexander, J., "Irreversible Contractures: An Impediment to Prosthetic Rehabilitation" *Newsletter Prosthetics and Orthotics Clinic*, 4:3, 1, 1980.

AUTHOR

Justin Alexander, Ph.D., is with the Albert Einstein College of Medicine, Yeshiva University, 1300 Morris Park Avenue, Bldg. 'J,' Room 2N4, Bronx, New York 10461.

Orthotic Correction of Blount's Disease

by Terry J. Supan, C.P.O.
John M. Mazur, M.D.

INTRODUCTION

Infantile tibia vara is the result of abnormal growth in the proximal tibial epiphyseal late of the tibial plate. Blount[1] first identified the condition as osteochondrosis deformans tibialis in 1937. Clinically, tibia vara presents itself as a severe bowing of the proximal tibia, without the associated bowing of the tibial shaft or the femur, which is evident in physiological bowleg. On radiological examination of the child with tibia vara, a beaking of the medial aspect of the tibia metaphysis is noted. In 1964, Langenskiold and Riska[2] developed a grading system for chronologically staging the development of the Blount's disease. Mitchell, et al.[3] advocated the use of the epiphyseal metaphyseal angle (E-M angle) as a simple quantitative measurement for Blount's disease in 1980. This method is useful to determine the severity of the disease and monitor treatment.

Historically, the use of orthotic management in the correction of Blount's disease has not proven to be as successful as hoped. The lack of correction and increased laxity of the joint capsule of the knee have been the main reasons for not continuing with orthotic management. To this point, the treatment of choice for individuals with Stage IV or an E-M angle of greater than 30° has mandated that the child undergo one of several types of tibial osteotomies. Because of the high incidence of complications[4] and the recurrence of the condition, the authors felt that a new orthotic approach should be investigated. The result of that investigation has been the development of a knee-ankle-foot orthosis. This orthosis has successfully been used in seven cases of Blount's disease.

ORTHOTIC DESIGN

Previous orthoses used in the treatment of Blount's disease have been either a KAFO with a medial side bar only, or a KAFO with bilateral side bars. The medial side bar KAFO incorporated a varus corrective knee pad. The bilateral side bar orthosis is essentially a passive device to maintain the existing condition and to prevent it from getting worse. Neither system has proven to be completely successful in the treatment of Blount's disease.

The design criteria established for the development of the knee-ankle-foot orthosis con-