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THE UTILIZATION OF MOVEMENT IN JOINT ROENTGENOGRAMS

By

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I have a feeling of hesitancy in presenting such a subject before a group of clinicians and I hope you will forgive me choosing such a subject that will to many of you only be review of methods that you daily apply and fully appreciate. However, I have thought that by presenting an outline of this subject, it may stimulate all of us to pool our interests and review some new and some old diagnostic methods of requesting roentgenograms. Those of us that deal much in bone and joint work learn not only to appreciate the standard positions for roentgenograms but frequently have evolved practical methods in showing, by unusual methods, what we may clinically suspect—yet not demonstrate by routine positions. We will omit the technical difficulties involved by the trained roentgenologist for this is certainly outside the scope of an orthopaedic surgeon to discuss. I may say that we, as orthopaedic surgeons, only ask of our friends, the roentgenologists, to always produce excellent pictures in the minimum amount of time and without errors of interpretation!

For some time now I have been impressed with the advantage of utilizing what has been called the functional test to increase our information regarding problems that arise from disabilities of the bones and joints. By this method we may graphically demonstrate ranges of normal and abnormal skeletal motion that can be produced and that may aid in the solutions of our problems. We are all aware of the value of utilizing tissue movement, for this is accomplished daily in the use of the fluoroscope for cardiac and G.I. problems. In the osseous system, however, the general conception of a rigid, bony framework has often caused us to overlook valuable data that can be elicited from filming the joints if we utilize movement.

In pathological states involving the bones and joints there are a

number of conditions in which excessive mobility can be demonstrated. The extent and variety of bone and joint lesions in which this principle can be utilized will depend both upon the ingenuity and the close cooperation between the roentgenologist and the orthopaedic surgeon.

It may be remembered that in ligamentous relaxations, such as recurrent dislocations or ligamentous tears in various regions of the body, the method is of great value. It may be accomplished by exerting force manually on the affected joint so as to record an appreciable amount of joint displacement, such as in an acromioclavicular dislocation, strains at ankles, knees, etc. Requesting oblique views of the wrist will also more clearly demonstrate a fractured carpal scaphoid. Bending the spine in flexion, in extension and laterally to the right and left will demonstrate a suspected pseudoarthrosis following spinal or lumbosacral fusion. These and many other examples may come to mind when we focus attention on this problem. (The roentgenogram should therefore be taken both before and after force or motion is applied. The unusual laxity seen sometimes in joint structures may be present in certain normal individuals but in these one can easily demonstrate a general relaxation of all the joints. In these instances, interpretation must be largely to the clinician's judgement to decide whether the laxity is normal or abnormal.)

In the spine let us consider the chronic lumbosacral strains without primary bone pathology which present an increased lumbosacral angle and give rise to stress and strain, causing persistent low back pain. By making lateral standing and supine views, often definite abnormal movement at the lumbosacral joint may be demonstrated, indicating the degree of instability.

Another example demonstrating this method is by taking preoperative x-rays in cases of idiopathic scoliosis. Here the bending plates of the spine are of great value in deciding the progressive nature of the curve. We also routinely take the patient's spine; supine, sitting and then standing with the leg inequality compensated by a block under the feet. In the supine position by bending the body strongly to the right and to the left to demonstrate and illustrate the initial and secondary curves which aid in choosing the operative site or sites for operation as well as decide the extent of the vertebral fusion that may be necessary. The functional test can also be of help in therefore evaluating certain types of operative procedures on the spine, particularly spine fusion and lumbosacral fusions. It it sometimes very difficult or impossible clinically to decide whether a fusion operation has resulted

in actual bony union but if two lateral films are taken—one with the spine extended and the other in the flexed position, and two a-p with lateral bending to the right and left, conclusive evidence regarding the integrity of the operative fusion can be obtained.

Again if relaxation or disease at the sacro-iliac joint is suspected, x-rays of the symphysis pubis show movement. This may be accomplished by having the weight shifted first upon one foot and then the other while an x-ray of the symphysis pubis is being taken. If movement occurs at this joint it is of some diagnostic importance in evaluating the abnormal motion in the sacro-iliac joint.

Among the disabilities of acquired origin are those resulting from fracture of the neck of the femur and here the dissolution of bony continuity can often be suspected clinically but one can strikingly demonstrate the range of mobility in non-union or delayed union of the neck of the femur by the so-called "push and pull" roentgenograms. We can demonstrate frank non-union or even whether the head fragment is firmly fixed to the neck by fibrous or bony union by the method of abducting and adducting the lower extremity. A comparison of these films will show whether the head fragment moves with the movement of the shaft and this may be of real aid in deciding upon the presence or lack of union. Another very important point to always look for in these cases of hip joint disability of long standing is whether the joint space is narrowed, obliterated or roughened and whether the socket is of normal depth or the socket is satisfactory in depth. It is only fair to say that an a-p view of the hip is very informative but a good "frog" position, if it can be possibly obtained, is also of great value. For some years now we have been taking an oblique view of the lumbosacral area and found it helpful for hip joint information with hip cases after surgery in conditions of congenital dislocation of the hip or in detecting early and definite changes in the head and acetabula very early in the Perthes' disease syndrome or in arthritis of the hip joint.

CONGENITAL DEFORMITIES

It is, however, in the congenital lesions of the bones and joints that this method of taking roentgenograms is of particular aid and various techniques may occur to the reader. It can give a very definite index regarding the degree of anteversion of the head and neck and if this degree is abnormal, it may be of practical value to correct during the course of treating the congenitally dislocated hip. Ordinarly we can

decide by manual examination that there is antevertion more than normal and estimate to correct this by internally rotating the limb, placing thereby the deep within the acetabulum and followed by a femoral osteotomy. If the knee is flexed at right angles to the thigh with the patient lying on his face and then the hip is internally rotated a determined number of degrees, we may then compute fairly accurately the angle of anteversion of the head and neck with the shaft and more accurately determine the deformity of the head and neck with the shaft.

In congenital dislocations of the hip it is also very necessary to stretch the contracted soft tissues by preliminary traction before any attempt at open operation and here the "push and pull" x-ray will give a great deal of information and demonstrate satisfactorily the degree of relaxation in the soft tissues. Again the application of this two x-ray methods may be of great prognostic aid when used preliminary to open operation to determine the degree of downward displacement of the head that can be obtained, following continuous skin or skeletal traction for a few weeks.

In clubfeet or congenital equinovarus we depend a great deal upon the functional test. *Kite* has pointed this out in the congenital deformities of the foot and we can evaluate the varus of the forefoot and hindfoot as well as the equinus before beginning treatment and by subsequent roentgenograms to determine the adequacy of treatment in the correction of each of the individual deformities. This will permit the orthopaedic surgeon to obtain a much better and more accurate correction of a congenital clubfoot. This will aid him in obtaining a better functional, anatomical and cosmetic foot.

In conclusion, therefore, may we say that the functional test as applied to the deformities affecting the bones and joints is of inestimable value in many locations of the body. I am sure many of these methods are familiar to you and probably many more occur to you than I have named. Roentgenologists and orthopaedic surgeons today are recognizing its value—as shown by the instances we have cited as well as by others that may occur to each of you. Of course, it goes without saying that the routine views of the bones and joints must always be employed.

SUMMARY

In certain postural deformities and traumatic disabilities and in certain congenital deformities of the spine and extremities the func-

tional technique is particularly applicable. Undoubtedly the ingenuity of the roentgenologist and the orthopaedic surgeon cooperating together will develop other opportunities for these basic principles to be employed.

RESUME

Dans certaines déformités de posture ou consécutives à des traumas et dans certaines déformités congénitales de la colonne vertébrale et des extrémités, la technique fonctionnelle est particulièrement applicable. Il n'y a aucun doute que l'ingéniosité du radiologiste et du chirurgien orthopédiste coopérant ensemble peut ouvrir la voie à d'autres possibilités d'application de ces principes de base.

ZUSAMMENFASSUNG

In gewissen Haltungsdeformiteten und traumatischen Behinderungen, weiterhin in gewissen angeborenen Verbildungen der Wirbelsöile und der Gliedmassen ist die funktionelle Technik besonders anwendbar. Unzweifelhaft wird die Erfindsamkeit des Röntgenologen und des Orthopäden in Zusammenarbeit andere Möglichkeiten der Anwendung dieser Grundprinzipien entwickeln.