THE ROLE OF PHYSIOTHERAPY IN THE FIELD OF SCOLIOSIS

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There is still a long way to go before the problem of scoliosis can be solved satisfactorily. To achieve this goal, the concern and co-operation of every branch of medicine is necessary. This includes physiotherapy.

The role of physiotherapy is threefold. First, the therapist must understand that scoliosis is a problem of great complexity, involving many different types and their concomitant problems. Secondly, the therapist can be of valuable assistance in the early detection of cases of scoliosis, providing she knows where to look. And thirdly, the therapist should have a knowledge of the various treatment techniques and should know how and where physiotherapy can be applied.

Simple as these three points seem, to follow them through entails a great deal of study. This writer speaks from experience, having recently embarked on a study project of the field of scoliosis and the role of physiotherapy in it. But if it results in even one individual being able to face life – and himself – with a straight back, it will be worth it.

The first two points will be considered together, since detection of a condition depends on knowing something about what one is looking for. Certainly, one is *not* just looking for obvious scoliotic curves. If a curve is obvious, then it is already too late to do very much about it. Dr. Walter P. Blount, of Milwaukee brace fame has stated that, although orthotists have learned to make good braces, and orthopaedic surgeons to use them, "the greatest difficulty at this point is that patients are often referred for treatment a year or more too late to obtain good results."[1] What is needed, then, is a good detection agency. I suggest that the physiotherapy department can be such an agency.

1) NEUROPATHIC CONDITIONS WITH SCOLIOSIS

In the past, one of the commonest types of scoliosis (the commonest was and still is idiopathic) was that which followed poliomyelitis. Now, there are very few new cases of poliomyelitis in Canada. But there are many *other* neuropathic conditions which very frequently have scoliosis associated with them. For example, in a study done in Winnipeg, Manitoba, it was reported[12] that out of forty-three well-documented cases of syringomyelia, twenty-seven (63%) had scoliosis. Another significant feature was that of the seventeen patients whose onset of symptoms occurred prior to age sixteen (the approximate age of completion of skeletal maturity) fourteen (82% of the seventeen) had scoliosis, as compared with twelve out of the remaining twenty-five whose onset began after age sixteen. It was suggested that the scoliosis was secondary to the pathology in the spinal cord, the result of muscle imbalance caused by involvement of the nerves from the affected spinal segment. The authors of this report listed several other observers who have reported scoliosis to be a common finding in syringomyelia. It should also be noted that, because of this high incidence, all cases of scoliosis should have a thorough neurological examination in case there are early signs of syringomyelia that have gone undetected. It can work both ways.

A more common type of patient in the physiotherapy department, but with a lower incidence of scoliosis (probably five per cent or less) is the cerebral palsy child. Scoliosis may be found in

spastics of the hemiplegic type due to overactive, unbalanced muscle pull along with retarded bone growth on the hemiplegic side. The developing scoliosis may go unnoticed for sometime, especially when ambulation is delayed. While bracing is almost impossible with these children, spinal fusion, though difficult, may be done. Treatment depends on evaluation of the child as a whole.

Perhaps the inherited condition called neurofibromatosis[13] or Von Ricklinghausen's disease may not be seen in the physiotherapy department unless a scoliosis has already been diagnosed. So the therapist may be more concerned with treatment than initial detection. Ten per cent of neurofibromatosis patients develop scoliosis. Usually the curves are short, severe and very difficult to correct. Left untreated, paraparesis or paraplegia may develop. While not certain, it is suspected that scoliosis is the result of pressure of tumours against the bone. Other manifestations of the disease are: café-au-lait skin pigmentations, subcutaneous neurofibroma nodules, overgrowth of a leg, or, rarely, complete disappearance of a bone.[13]

Also neuropathic in origin, conditions such as diastematomyelia, spina bifida and myelomeningocele may be complicated by scoliosis. Dr. R.B. Winter[14] reported a case of a child with spina bifida and myelomeningocele who had begun to develop a severe curve by three years of age. The scoliosis was the result of paralysis, and was not related to the congenital abnormality.

Two more neuropathic conditions which may be seen in physiotherapy, Friedreich's ataxia and Charcot-Marie-Tooth neuropathy, may be found to have an associated scoliosis. Treatment is a problem, though. For example, the patient with Friedreich's ataxia may have difficulty with gait after spinal stabilization or even after a body applicance because the entire pattern of balance has been altered.[14]

2) MYOPATHIC CONDITIONS WITH SCOLIOSIS

In the pseudohypertrophic form of muscular dystrophy, muscle paralysis can result in a collapsing trunk in the later stages of the disease. This can make sitting a problem and can limit breathing capacity severely.[13] A severe lordosis may be present as well.[14]

Friedlander and Westin (1968)[6] have reported, in a review of forty-five cases of arthrogryposis multiplex congenita, "Many authors consider arthrogryposis to be a condition affecting primarily the extremities; involvement of the trunk is seldom mentioned. In our series, there were numerous instances of trunk involvement, the most common being thoracolumbar scoliosis (twelve cases) and rib-cage abnormalities (ten cases)." Three spinal fusions for scoliosis were done in this series.

3) CONGENITAL ANAMOLIES AND SCOLIOSIS

Children with either upper or lower extremity anamolies may have an associated scoliosis of a severe degree due to a disturbance in embryological development.[14] In one report[17] of upper extremity anamolies, such as radial and ulnar hemimelia, phocomelia and amelia, thirteen (48%) of twenty-seven patients had significant idiopathic scoliosis, while two more patients had congenital scoliosis, and three were questionable. Congenital anamolies of the spine itself, such as hemivertebra, wedged vertebra, unsegmented bony bar etc., are classified as congenital

scoliosis.[14] The closer to the mid-line the anamoly is, the greater the chance of an associated anamoly of the internal organs which may make a corrective surgical procedure difficult. MacEwen (1969)[14] reported a child with a severe lumbar scoliosis who had only one kidney and was hypoplasic. Obviously the kidney problem was the more serious of the two.

4) METABOLIC CONDITIONS AND SCOLIOSIS

Marfan's syndrome (arachnodactyly) has numerous possible manifestations, one of which is scoliosis. There are usually two severe primary curves, each commonly over 100°, resulting in a very serious rapidly deteriorating deformity.[13] Marfan's syndrome is a relatively rare hereditary disease, with a tissue disorder producing laxity of ligaments and joint capsules.[15] Several authors have compared Marfan's syndrome to lathyrism (which has been shown to produce scoliosis in rats (Ponseti and Shepherd, 1954) but not in humans.)[26] However, lathyrism affects collagen whereas the lesion in Marfan's syndrome appears to be in elastic tissue.[15] Lathyrism has more in common with Ehlers--Danlos syndrome which is characterized by skin laxity, dislocations, dissecting aneurysms and scoliosis.[24] Ehlers-Danlos syndrome is also quite rare.

It may be noticed that in many of the conditions mentioned, the incidence of scoliosis is not mentioned. Also, many of these conditions are uncommon. But, it is *because* of these two factors that the possibility of scoliosis can often be overlooked until it announces its own presence in the form of an obvious deformity -- which is then so much more difficult to manage. Early detection is crucial, but you have to know where to look.

Up to this point, the emphasis has been on detecting scoliosis in patients who have initially been referred for something other than their scoliosis. But what about the preson with idiopathic scoliosis, the commonest type of all, who is otherwise normal and may not even know she (90% of adolescent idiopathic scoliosis occurs in females) has it? Here, Dr. Blount[1] stresses the importance of mothers looking at their sons and daughters in the forward bend position. So, married physiotherapists with children can begin detection at home! Dr. Blount also mentions that occasionally a school nurse or physical education teacher will pick up an early deformity.[1] This suggests a challenge to the physiotherapy profession to develop its inter-professional relationships. If there were greater interaction and exchange of information between these professions which, in fact, have a great deal in common, the process of early detection of scoliosis would be much more efficient and effective. The reader can perhaps think of ways in which he or she can work this out. But, no matter how arranged, inter-professional co-operation could be a very important factor in the early detection of scoliosis.

TREATMENT TECHNIQUES

There are three main types of treatment for scoliosis:

1. Milwaukee brace with an exercise program,

2. corrective casts and
3. surgery.

A fourth might be added, namely that of traction. Two recently developed traction devices will be mentioned.

Where, then, does physiotherapy fit in? In the past, there have been various exercise routines devised to "correct" scoliosis. Almost the only one still used today was devised by Rudolf Klapp in 1904, and consists of creeping exercises.[14] Exercise alone has never proved adequate. Spitzy has been quoted as saying, "The exercises are good for the children, but they don't do much to correct the scoliosis."[14] However, exercise in *conjunction with* other treatment modalities can assist in the correction of scoliosis.

1) MILWAUKEE BRACE

This brace is a dynamic, not a passive device, and depends on active correction by the patient. The actual brace construction will not be described here; but, it is imperative that any therapist treating a patient in a brace must be familiar with all the *details of fit,* since she is more often in contact with the patient in the initial stages than either the doctor or the orthotist. *A poorly fitting brace cannot produce a good result,* even though exercises are faithfully carried out. Dr. Blount has stated, "Correction occurs more quickly and completely if the patient has regular periods of active exercises under a specially trained physical therapist. He (the therapist) may offer suggestions to the orthopedic surgeon that are of inestimable value. This is particularly true with regard to lengthening of the brace, tilting of the pelvic girdle and bending of the bars that are too close to the torso."[3]

As for the exercise program, ideally it should be started before the patient goes into the brace. Later, exercises are done *in the brace.* They serve three purposes: 1) to strengthen the trunk muscles which otherwise would become weakened from prolonged brace support (over a period of years), 2) to develop good posture, 3) to train active curve correction. The exercises[14] are:

1. Supine: pelvic tilt with knees flexed
2. Supine: pelvic tilt with knees straight
3. Pelvic tilt against the wall in standing
4. Sit-ups with pelvis tilted and feet fixated.
5. Posterior chest expansion in lying (thoracic valley will fill out.)
6. Posterior chest expansion in standing (resistance can be applied for strengthening.)
7. Active distraction: lift head up and away from throat mold. "Stand tall and look over the fence."
8. Active correction of lateral curve and rotation. Patient pulls away from the pads, first singly and then simultaneously.
9. Push-ups in and out of the brace.
10. Walking while maintaining good posture and pelvic tilt.

Localized "breathing" exercises are important in correcting the common tendency towards a *thoracic* lordosis.[8] Exercises are done ten times, once or twice daily. In addition, a program of vigorous activities such as volleyball, tennis and skating is encouraged. Swimming, where

possible, is an excellent sport.[3] The brace is worn twenty-four hours a day until cessation of skeletel growth (a controversial subject) or until there is sufficient radiological and clinical evidence that permanent spinal stability has been achieved. Only then is the "weaning" process begun, which commonly takes one year. In some cases the brace is worn for a further year at night only.[14]

Obviously, this is not an easy regime to establish, especially if the patient is an adolescent girl who is just beginning to be concerned about her appearance. (There are patterns for clothing especially designed to minimize the brace projections) But, this writer knows of no studies of the psychological effect of this very long term therapy. Referring to patients who had residual deformity, Goldstein asks, "Who knows what compromises in ambitions, career, choice of mate, etc., were made along the way?"[14] He suggestes that a psychological examination in depth be required. Moe reports a treatment failure because the patient was "unco-operative."[21] This is an area of challenge to the physiotherapist who should be able to assist the orthopaedic surgeon in preparing the patient psychologically for the treatment program. She should be familiar with the details of the over-all treatment plan and can help interpret it to the patient's family, the mother in particular. Over-protection of the patient should be warned against.

2) CORRECTIVE CAST

The cast is a passive form of correction although some types permit limited exercise. The main types in use today are the Risser localizer cast and the Cotrel cast. The surcingle cast is used in the United States[14] and Roaf in England uses the Abbott jacket for post-operative convalescence.[26] Casts are used for the primary purpose of stretching soft tissues to obtain correction of a curve pre-operatively and for post-operative immobilization to ensure optimum healing of the spinal fusion. Surgery is performed through a large window cut in the cast and patients are discharged post-operatively in the cast. The development of pressure sores is the main drawback.[14] But also, there is a significant decrease in vital capacity and maximum breathing capacity if the Risser localizer cast is used.[7,11,16] Therapists should take note of this in cases of limited respiratory function.

3) SURGERY

This is a very complex and controversial subject, encompassing a variety of procedures. As in all surgery, success depends on the skill of the surgeon and meticulous technique. In most cases, the procedure used is spinal fusion. The purpose of this is to either hold a curve in a corrected position or to prevent further progression of a curve where correction is not possible. Surgery almost always involves the use of casts pre and post-operatively as has been mentioned. The introduction of the Harrington instrumentation procedure has resulted in improved management of severe cases. This procedure uses a prestressed, stainless steel, metallic system of hooks and rods to straighten and immobilize the spine by application of the principle of distraction and compression.[11] However, it has brought with it its own set of complications in the form of a rod breaking or the top hook breaking out of position.[13] Happily, these complications are

occurring less frequently. Post-operative care[10] following the Harrington procedure involves application of a localizer cast which is windowed to permit breathing exercises. These are done five or six times a day, as well as isometric arm and leg exercises to prevent muscle atrophy and thrombus formation. *This is important* since the patient usually remains recumbent for three months post-operatively (though discharge is after two or three weeks.)[10,14] In selected cases, ambulation in the localizer cast has been permitted two weeks post-operatively.[14]

In surgery of the spine, cardio-pulmonary function often presents a problem. This is of interest to physiotherapists. Death has resulted from cardio-pulmonary dysfunction caused by a severe scoliosis.[16] Collis and Ponseti have reported a correlation between degree of curvature and per cent of predicted normal vital capacity.[5]

Degree of Curve	Per Cent of Predicted Normal Vital Capacity
80-90°	80%
90-99°	71%
100-140°	58%
over 140°	36%

This can act as a guide for physiotherapists when carrying out pre and post-operative chest routines. While spinal fusion does not result in significant objective improvement in vital capacity,[7,16] very often the patient reports marked subjective improvement and an increase in endurance.[7]

Surgical procedures other than spinal fusion include lateral epiphyseodesis, as yet of questionable value,[14] and thoraco-plasty (rib hump resection) as a cosmetic procedure.[11,13] Excision of a hemivertebra is still a rather dangerous procedure[14], the one exception being at L5 which puts the patient into a position of marked decompensation which he is unable to correct. Since the excision will be below the conus medullaris, it is a much safer operation than at a higher level.[14]

Complications from surgery include: surgical death, paraplegia (usually on a vascular basis), lordosis, hepatitis, pneumonia, pneumothorax, lengthening of the curve, wound infection, and pseudoarthrosis (the most common of them all.)[14]

4) TRACTION DEVICES

a) The Halo traction was first introduced in 1959 by Perry, Garrett and Nickel as a method of stabilising the collapsing spines of patients paralyzed by poliomyelitis. It is particularly useful for high thoracic or cervical curves or when extensive fusion is required. As with casts, surgery is performed with the patient in the device, which is left on postoperatively anywhere from two to twelve months.[7] The Halo has two advantages over the localizer cast. 1) In cases with sensory defect, the danger of pressure sores is almost eliminated. 2) Pulmonary function is not reduced as it is by application of a cast.[7] However, there are possible complications. The physiotherapist can assist greatly in detecting their onset. They are: brachial plexus root stretching and paralysis of the sixth cranial nerve which is the first nerve to be affected by traction on the brain stem.[14] Chances of cord paralysis in cases with a kyphosis are extremely high since traction pulls the spinal cord directly down on a sharp curve. It is important that traction be released immediately

upon detection of any such neurological sign. Therapists should maintain careful observation.

b) The Cotrel traction method was developed by Dr. Y. Cotrel of Berck Plage, France, and requires a long period of hospitalization – up to three years. (The psychological effect of such an extended period on a growing individual should receive serious consideration.) The head is pulled upwards by a halter (as in cervical traction), and the pelvis is pulled downwards (as in lumbar traction.) The patient remains supine on a moveable trolley, but carries out stretching exercises and progressive respiratory training under the rigorous supervision of a physiotherapist.[30] Complications with this method are similar to the Halo apparatus but are perhaps less frequently seen because the distraction is carried out more slowly over a longer period of time.[14]

SUMMARY

The role of physiotherapy in the field scolicsis has been discussed The therapist should have an overall understanding and grasp of the complexity of the subject The therapist can be of assistance in the early detection of scoliosis which is associated with various conditions, many of which require physiotherapy for aspects of the disease other than scoliosis. The physiotherapist should have have a knowledge of the various treatment modalities, their purpose and possible complications as well as the part physiotherapy has to play in the treatment program.

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