AN INVESTIGATION INTO MINOR ORTHOPAEDIC DEFORMITIES

IN

FIRST YEAR SECONDARY SCHOOLCHILDREN

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Introduction

In a previous contribution to this Bulletin (Moncur, 1965) attention was drawn to the importance of 'minor' deviation in form and function of the vertebral column as a sign of underlying bony abnormality of the type found in Scheuermann's disease. It was suggested that we should not be satisfied with the existing standards which are accepted as 'within normal limits' and that an earlier recognition of malfunction of joints leading to Degenerative Joint Disease was possible. A small study was instituted into spinal form and function, including radiography, in fifty-three students at the Scottish School of Physical Education, all of whom had been admitted for training at the same time and all of whom had recently left school. None had physical defects which would warrant outright rejection from the course but few had backs which a Physical Educationist of the 'old school' would have regarded as satisfactory!

The commonest types of clinical defect are illustrated, Fig.1 and Fig.2 with their radiographs Fig.3 and Fig.4.

Of the fifty-three students examined, four were regarded as clinically normal, thirty-one exhibited stiffness as shown in Fig.1 and eighteen a greater or less degree of deformity as shown in Fig.2.

Radiologically forty-seven students had an abnormality. Thirty had wedging of the vertebrae, twenty-four exhibited Schmorl's nodes. The six students who were radiologically normal had shown clinical signs of stiffness and two of those who had been regarded as clinically normal were found to have a radiological abnormality. In thirty-eight cases the level of the clinical signs corresponded approximately with the radiological abnormality in the rest the radiological defect was above the level of the clinically suspicious area.

It seems reasonable to speculate that there is a connection between the clinical findings and the permanent radiological changes, and that there would be lessened risk of developing permanent bony changes had the joints remained mobile and in good relationship with each other. On the basis of this speculation the following investigation into joint function in twelve-year-old children was undertaken.

Material

Fifteen secondary schools in Glasgow were selected so as to give as wide a social spectrum as possible. One class in each school was chosen of those children who were in their first year of secondary education.

Fig. 1. Stiff area in the high lumbar region demonstrated on forward flexion.

Fig. 2. Mild Kyphosis in the thoracolumbar region well seen on assuming the 'stretch-standing' position in gymnastics.

Fig. 3. X-Ray of subject in fig. 1.

Fig. 4. X-Ray of subject in fig. 2.

Seven classes were boys, seven classes were girls and one class was mixed, giving totals of 237 boys and 170 girls examined. The classes were selected only on the basis of their physical education period coinciding with a time which was convenient for the examination to be carried out, no account being taken of educational or physical ability.

Method

A. The children's backs were examined in the erect position with arms stretched overhead and in the stooping position. If a deformity was present an attempt was made to correct it manually, and only those in whom manual correction was not possible were recorded as abnormal, i.e., purely 'postural' abnormalities were disregarded. Grading was as follows:-

Grade 1. (normal) A smooth curve of the back on stooping, with no flattening (localised stiffness), slight extension of the thoracic curve on stretching the arms overhead with free extension of the lumbar curve. In this position there should be a groove of more or less even depth between the paravertebral muscles. Figs. 5 and 6.

Fig. 5. Smooth curve of back on stooping.

Fig. 6. Normal back in extension.

Grade 2. In stooping, a flattening of part of the curve of the back (stiffness) or, in standing with the arms stretched overhead, an inability to extend the thoracic spine. Figs. 7 and 8.

Fig. 7. Flattening on stooping.

Fig. 8. Inability to extend spine.

Grade 3. Well marked stiffness in stooping or uncorrectable kyphosis. Fig. 9 represents the least deformity seen here. Fig. 10 represents a well marked kyphosis.

Fig. 9. Least deformity graded 3.

Fig. 10. Well marked Kyphosis.

B. Two conditions of the toes were sought:-

1. Deviation of the Hallux.
2. Stiffness of the Hallux.

Standing on a board as shown, Fig. 11, an assessment of Hallux Valgus was made as follows:-

Grade 1. Deviation from the straight line running along the medial border of the foot up to 15 degrees.

Grade 2. Deviation up to 30 degrees.

Grade 3. Deviation over 30 degrees.

Dorsiflexion of the Hallux was coded thus:-

Grade 1. Dorsiflexion over 75 degrees.

Grade 2. Dorsiflexion from 45 - 75 degrees.

Grade 3. Dorsiflexion under 45 degrees.

C. Rotation of the tibiae was measured by protractor, Fig.11. With child sitting and the patellae pointing to the roof of the foot was dorsiflexed and the angle of rotation from the vertical taken from a line through the second toe.

Coding was as follows:-

Grade 1.	Less than 15 degrees.
Grade 2.	Between 15 and 30 degrees.
Grade 3.	Over 30 degrees.

Fig. 11. Apparatus for measuring Hallux Valgus and Tibial Rotation.

D. A record of the parental social group was kept.

Results

	<u>Vertebral Column</u>		
	Grade 1 (normal)	Grade 2 (stiffness)	Grade 3 (deformity)
All Data	133	136	138
Boys	81	81	75
Girls	52	55	63

The significance levels of the difference between the various groups was tested. No significant difference was found between Boys and Girls, nor between boys by social class, nor Girls by social class.

	<u>Lateral Rotation of the Tibia</u>		
	Grade 1 (under 15°)	Grade 2 (15 - 30°)	Grade 3 (over 30°)
All Data	331	74	2
Boys	194	42	1
Girls	137	32	1

No significant difference was found between the sexes or by social class.

	<u>Hallux Valgus</u>		
	Grade 1 (under 15°)	Grade 2 (15 - 30°)	Grade 3 (over 30°)
All data	227	167	13
Boys	233	4	0
Girls	161	9	0

Grade 1 was further broken down into those showing no deviation and those showing deviation of less than 15° :-

	<u>No Deviation</u>	<u>Deviation less than 15°</u>
Boys	154	79
Girls	75	86

Here there was a highly significant difference between boys and girls (P less than 0.0001). No difference was found by social class.

Stiff Hallux

	Grade 1	Grade 2	Grade 3
All data	378	21	8
Boys	222	11	4
Girls	156	10	4

No significant difference was found between boys and girls. Numbers were insufficient to break down by social class.

Medial rotation of the tibia was also recorded but this was found in only nine cases, eight boys and one girl, and was less than 15 degrees in all cases.

Discussion and Conclusions

The investigation here reported was deliberately kept simple and the examinations carried out are well within the scope of anyone who is in a position to see a child partly clothed and performing simple movements. It was not considered justifiable to submit these children to X-Ray examination mainly on the basis of exposure to radiation but also in the knowledge that such examination at this age would be unlikely to yield positive results. Far more important is the fact that malfunction of joints can be adequately demonstrated clinically and probably precede any radiological change. If any of the children showing deformities as illustrated were to develop symptoms, which appears to be rarely the case, and were to be seen in a Department of Orthopaedics or Physical Medicine, it is highly likely that they would be asked to undergo exercises in an attempt to improve their posture and joint mobility and it can be shown that such improvement is certainly possible.

Fig. 12. Scheuermann's Disease in 15 year old.

Fig. 13. Improvement of Deformity after 7 months.

The illustrations, Fig.12 and 13,

show such an improvement in a fifteen-year-old boy who had been referred to hospital with back pain. This improvement occurred between February and September in one year and may continue. His history makes a point. He was not subjected to a course of formal Physiotherapy but was referred to his Physical Education teacher who agreed to guide him in exercises designed to improve his posture and mobility and, being an intelligent boy, I have no doubt that he was carrying out exercises at home as well. His physical activity at school was curtailed only in the sense that he was not allowed to play Rugby in the scrum but he has since returned to the game as a back. His exercises occupied about five minutes of his normal gymnastic programme on two days per week with an obvious saving of time compared with what would have been necessary had he attended a Department of Physiotherapy and the added advantage that he was not regarded as being 'sick!' It is surely reasonable to suppose that this deformity would not have occurred had this boy had the attention to his physique which should be given in the gymnastic programme both in Primary and Secondary School. It is not my intention to suggest that teachers of Physical Education should be Physiotherapists or Remedial Gymnasts but they should surely act in a prophylactic capacity and be aware of slight departures from 'normal;' indeed their whole training is geared to the recognition of skilled performance, and the eye which can see faults in skills of throwing, jumping, climbing, etc., should also be aware of the more fundamental skills of sitting, standing and walking. In view of the well recognised connection between faulty body mechanics and the later development of Degenerative Joint Disease there is an important role here for the teacher of Physical Education to play in Preventive Medicine, and although the role may be small in relation to the other tasks which the teacher is called upon to do, there is none that is of more importance, particularly since the time during which physical education can benefit many children in this respect is, on the evidence presented, limited to the Primary School.

With regard to deformities and stiffness of the spine and stiffness of the toes there seems little doubt that much of this could be prevented. Deviation of the Hallux is, of course, a more difficult problem concerning as it does attention to both socks and shoes but even here daily running about without footwear and teaching of accurate movements in walking, skipping, running, etc., would play some part in lessening the effects of the insults of faulty footwear, and the objections to this on the basis of foot infections should surely no longer be valid with modern methods of sterilising floors. Tibial rotation deformities are a greater problem since many may be present before a child reaches school but even here it is not beyond the bounds of possibility that the skeleton would adapt to mechanically sound movement as long as the growing bones are able to do so.

It cannot be denied that the picture presented in this paper is unsatisfactory. It is not likely to be confined to Glasgow as the students reported on in the Introduction come from all over Scotland and no significant differences were found between social classes. It seems that we are allowing to develop unnecessarily a large reservoir of candidates for treatment in Departments of Physical Medicine and with an aging population the economic implications are obvious.

Summary

1. A report on minor Orthopaedic abnormalities in 407 schoolchildren is presented.
2. It is suggested that more of these deformities are preventable and that prophylactic measures are within the province of the Physical Education Teacher in schools.

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Reference

Moncur, J.A.; Bull. B.A.S.M. Vol. 2. 2. 44-48. 1965.

The paper on chondromalacia of the patella, by Surgeon Commander P. FULFORD, F.R.C.S., M.Ch., R.N. shall be published in the next issue.