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SPINAL MOBILITY AND POSTURE IN CHILDREN
A follow-up examination from 5 to 14 years of age

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Abstract: *Spinal mobility, posture and stability of joints were studied in 3154 children from 5 to 14 years of age (they were structurally healthy). The spinal measurements were carried out by noninvasive goniometric methods. Besides these, Howmedica protractor and centimetre-band were used. The forward flexion of the spine were measured with centimetre, but the comparsions were happened by calculation of peercentage. The measurement, punctuality, reproductibility is demonstrated as well. The data handling were happened by computer system. Instead of average value was done a distributionally curvature. Significant sexual change was not found. All spinal motion became smaller to 14 years of age, except the spinal rotation which schowed significant polarisation (may find small and large values as well). The posture showed right correlation with forward flexion ability of spine. The examination of normal values of spinal motion gives more chance to understand better some spinal disease and can help in an accuratelly follow-up treatment.*

Key words: *Spinal mobility; Posture; Budapest children.*

Introduction

At the starting time of this longitudinal examination don't have been found home publication. Since then the spinal mobility had been publicated by Domjan (1989). None longitudinal examination was happened. Few authors have described a little number of examined cases. Children's spinal mobility have been studied in 30 cases by Mellin (1988). Few studies on spinal mobility and posture in children have been carried out (Loebl 1967, Mellin 1986, Sward 1990). Our resultes are impossible to compare with some other studies.

The deffinition of various spinal movements are well establilshed, but a great number of measuring instruments have been described. Mellin (1987) have used an inclinometer to measure the spinal rotation. Postural spinal curvatures were measured with Debrunner's kyphometer (Ohlen 1989). We could found some other methods as well (Helsing & Regio 1987, Loebl 1967, Mellin 1987, Moran 1979, Salisbury 1987, Willner 1983). Our measuring instruments have been chosen because of their punctuality, reproducibility and cheapness. Before starting 100 test-measure had happened, to get the instruments choice easier. The following instruments were used: Howmedica protractor, special protractor for measuring a spinal rotation and centimetretape.

Materials and Methods

Subjects

The presented examination have been started in 1980. 2000, 5 year old children have been chosen (from various nursery). Measurement of spinal mobility and posture has happened. This examination have been repeated at their age of 10 and 14 years. The examined subjects were divided into various groups sex, according to age, etc. The data handling have been carried in computer system out. The total number of examination was 3154.

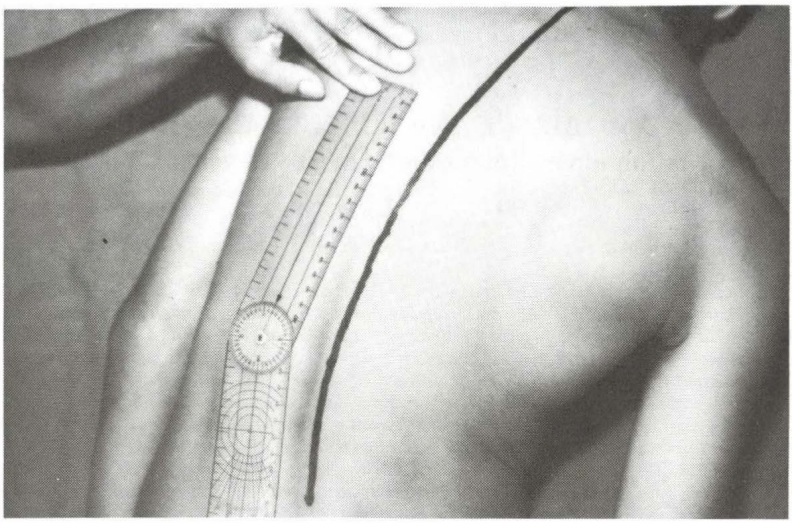

Fig. 1: Measurement of the lateral bendig of the spine

Fig. 2: Measurement of the spinal rotation

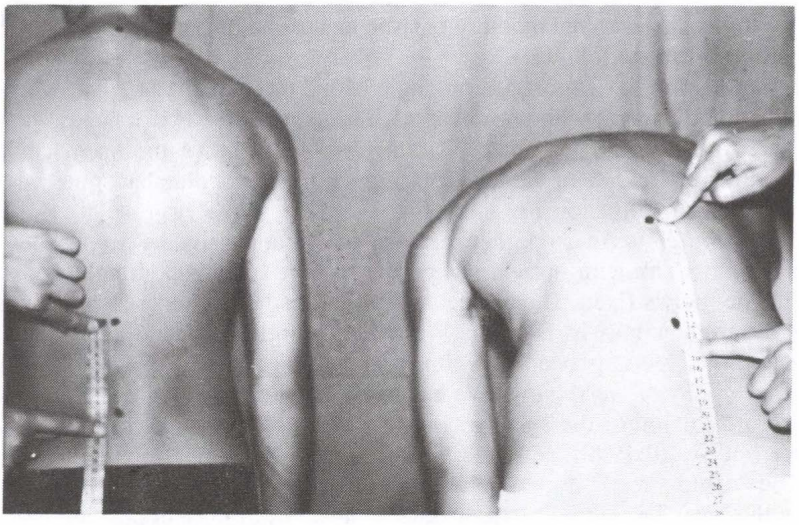

Fig. 3: Skin marks and measuring of the spinal flexion ability

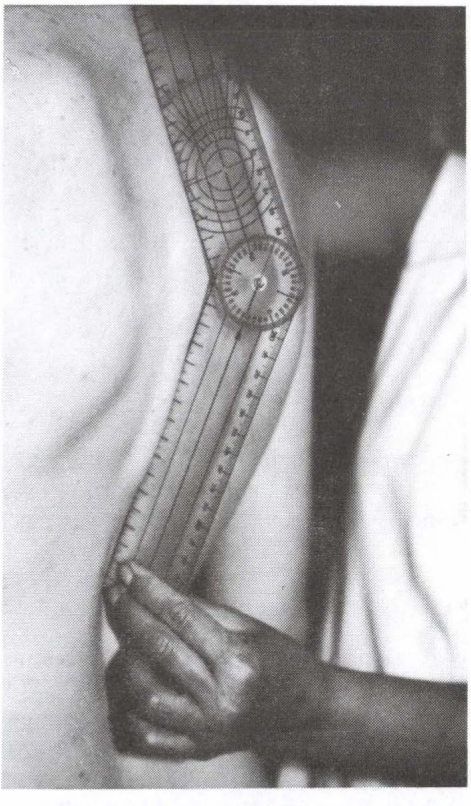

Fig. 4: Measurement of the thoracic kyphosis

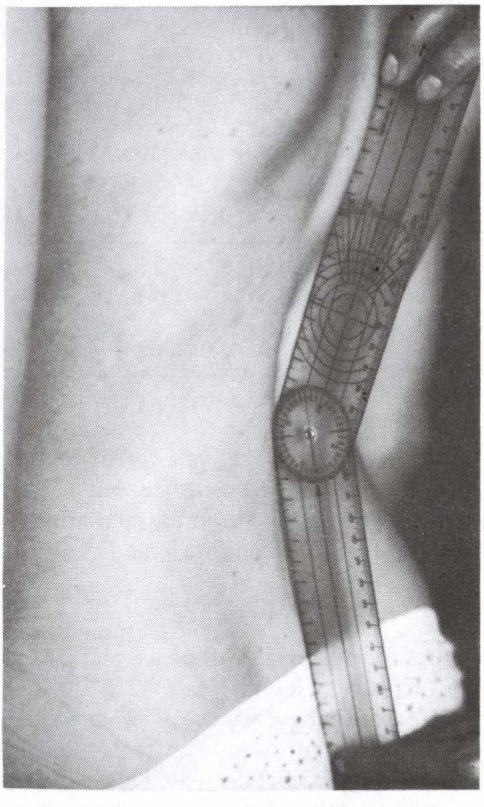

Fig. 5: Measurement of the lumbar lordosis

Methods

Three dimensional spinal mobility measurements and measuring of posture happened. The methods were the follows:

Lateral bending of spine — It's an angle of the thoracolumbar spine when the child bends maximally lateral with upright spine. The subject stands in a neutral position with the feet 20 cm apart. The subject was then asked to move the open hand as far as possible down to the side of the leg. The angle of the thoracolumbar spine was measured with Howmedica protractor (*Fig. 1*).

Spinal rotation — An angle between the pelvic and shoulder level when the child rotates his/her trunk with upright spine. The subject stands up stringht, looks forward, keeps his/her pelvis fixed. The subject looks over his/her shoulder as far as possible and rotates the trunk axially as possible. We note the angle between the shoulder level and the upper projection of pelvic level with special protractor (*Fig. 2*).

Flexion ability of the spine — We examine separately the thoracal and lumber spine. The forward flexion of the spine was measured according to the method developed by Schober (cit Sward 1990), and modified by us. We have measured an ability in which the spine "could stretch" in maximal forward flexion. In upright position we mark the skin on the level Th_1, Th_{12}, L_5 (processus spinosus!). In upright position was measured the distance between $Th_1 - Th_{12}$ and $L_1 - L_5$ after that the subject was asked to bend forward as far as possible and the new distance between the marks was measured using a centimetre tape.

We have to calculate a per cent with helping a mathematical formula: Km% = ability of the thoracic forward flexion;

Lm% = ability of the lumbar forward flexion (*Fig. 3*)

The formulas of the calculation are the followes:

$$100 - \frac{\text{distance between } Th_1 - Th_{12} \text{ in upright position (cm)}}{\text{distance between } Th_1 - Th_{12} \text{ in max. forward flexion (cm)}} \cdot 100 = Km\%$$

$$100 - \frac{\text{distance between } _{L1} - _{L5} \text{ in upright position (cm)}}{\text{distance between } _{L1} - _{L5} \text{ in max. forward flexion (cm)}} \cdot 100 = Lm\%$$

Spinal sagittal positional curves (thoracic kyphosis and lumber lordosis): The angle of kyphosis was measured between $Th_1 - Th_{12}$ it's punct. max. and the lumbar lordosis between $_{L1} - _{L5}$. We used for measuring a Howmedica protractor. The degree was read directly from the scale (*Fig. 4* and *5*).

Results

Significant sexual difference and difference in relation right or left side of motions don't have been found.

The physiologycal curves (what we have got) have shown a clear trend of spinal mobility change during the child growes up. The *lateral bending of spine* (*Fig. 6*) showed a significant decrease between 5 and 10 years of age (30° → 20° in spike).

Spinat rotation (*Fig. 7*) have shown some special polarisation. We could find children with high and low values of rotation in the same group.

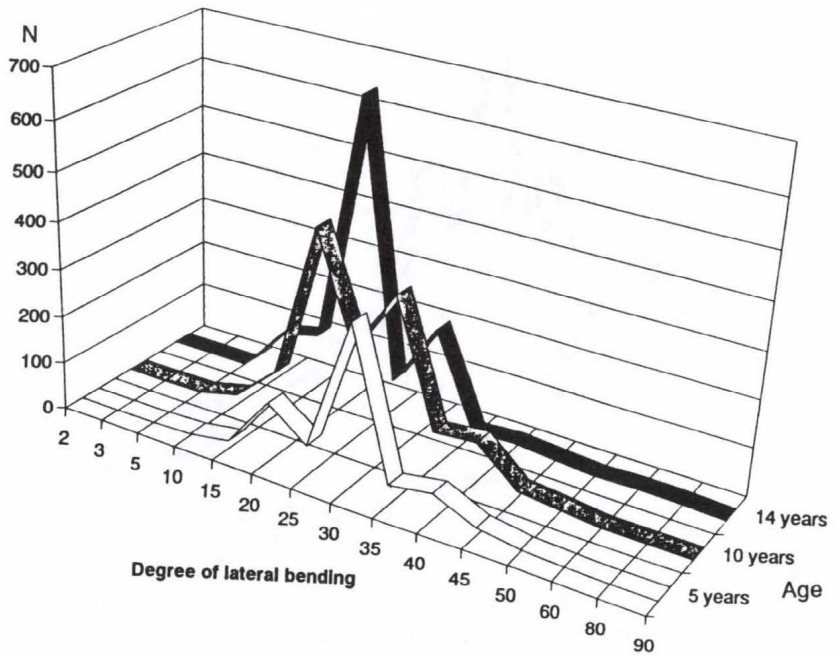

Fig. 6: Lateral bending of the spine in children examined

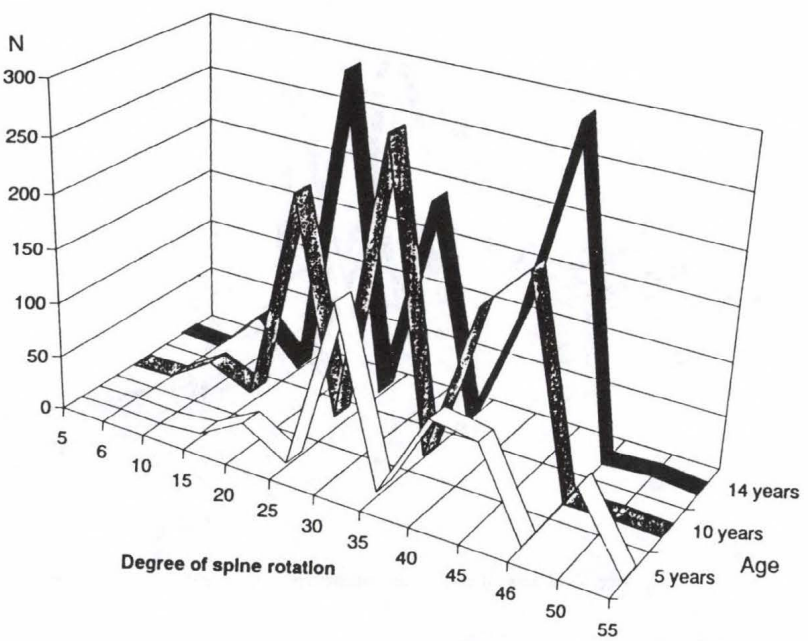

Fig. 7: Spine rotation

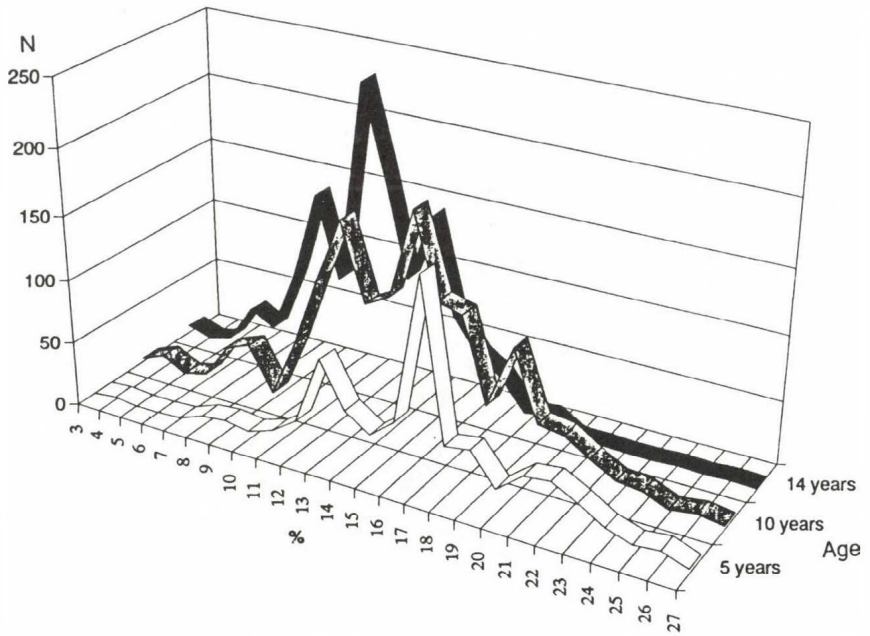

Fig. 8: Flexion ability of the thoracic spine (per cent)

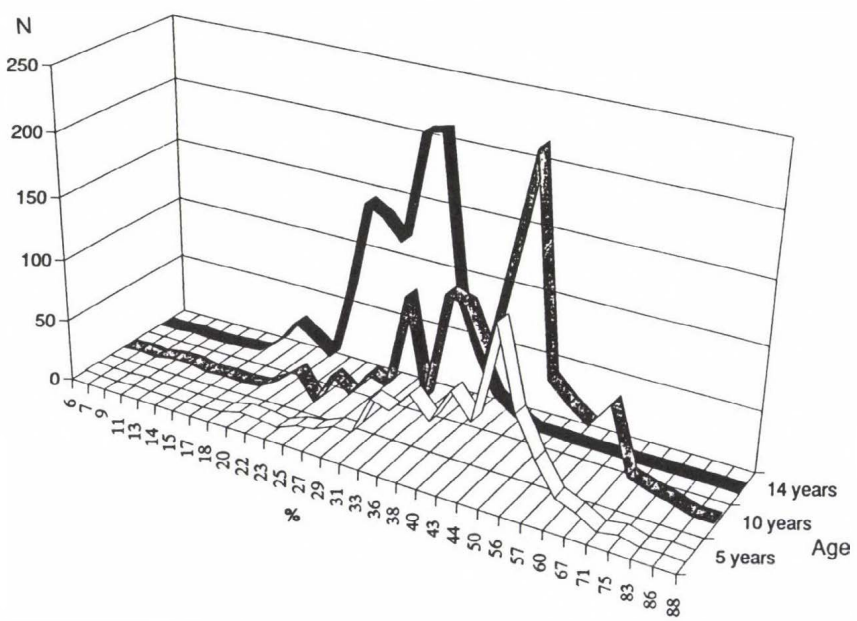

Fig. 9: Flexion ability of the lumbar spine (per cent)

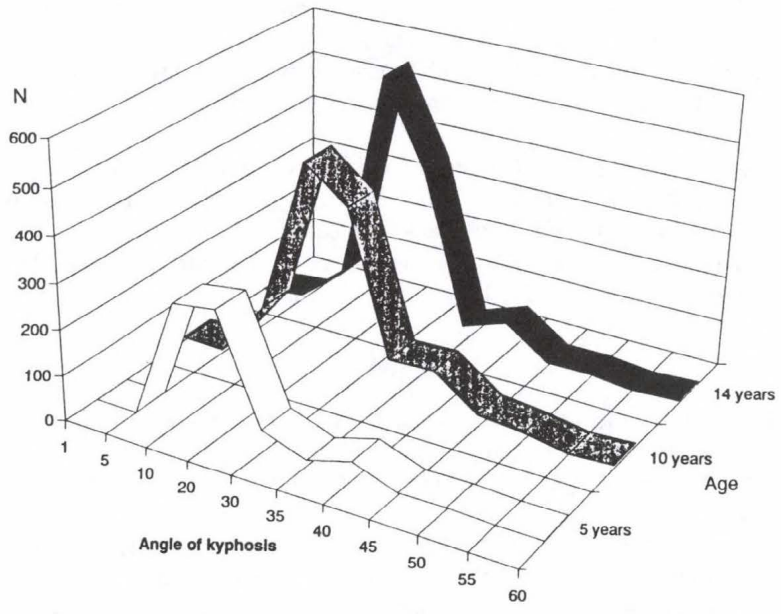

Fig. 10: Angle of the thoracic kyphosis

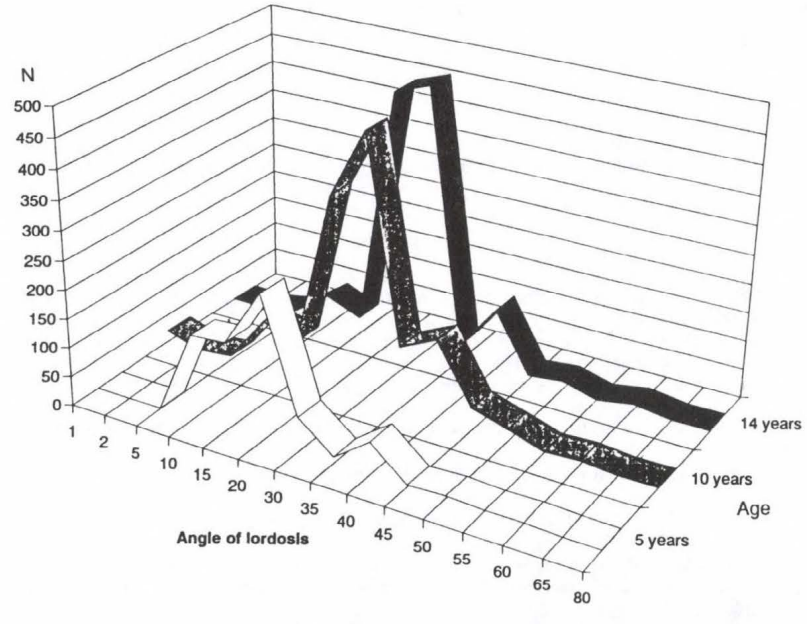

Fig. 11: Angle of the lumbar lordosis

Flexion ability of the thoracic spine (Km%) have shown a decrease (spikes: 17%–13%–10%) during a growing period (*Fig. 8*).

Flexion ability of lumbar spine (Lm%) Doesn't show any change between 5 and 10 years of age. After 10 years of age happenes a clear decrease in a great degree: 50° → 29° (*9. ábra*).

Thoracic kyphosis angle (*Fig. 10*)) shows an increase between 5 and 10 years of age. After 10 years we don't find any other change (20° → 30°), but all age-group contains children with increased kyphosis, more the 40 degree, as well.

Lumbar lordosis angle (*Fig. 11*) The behaviour of the curves are similar to the thoracic kyphosis, the change is also between 5–10 years of age.

Conclusion

External measurements are less expensive, quicker and are relevant to clinical practice. The authors' opinion is that the generally used average values, min. and max. values are unsuited for comparsion any change. We had better to prepare "population curves" to compare the trends exactly. The curves we have got are suitable for being standard. In general, the spinal motion become decreased for ages, but the rotation showes a "polarisation" (besides average values, a number of children has little or great value of rotation) and the decrease of the lumbar spine flexibility happens only later. So we may find a group of population in which the *spine are "physiologicaly unstable" (increased rotation value plus increased lumbar spinal flexibility). The spinal sagittal positional curves may have a physiologic increasing as well.*

The theory of physiologicaly unstable spine accuntes easy for a great number of postural defects. This finding could help to understand better the cause of spinal diseases and postural defects, and their differences. It also permits a full investigation of the sagittal configuration and mobility of the spine in every patient with a spinal problem.

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