

# APPLICATION OF INDIVIDUAL SPHEROSOMATOGRAMS IN SPORTS ACTIVITIES

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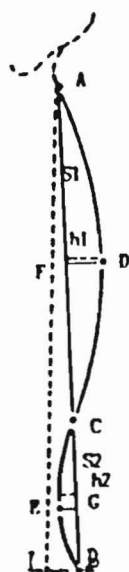
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## INTRODUCTION

The idea of using electronics to measure curves in space was applied in 1974 by the construction of the electronic spherosomatograph, permitting the simultaneous recording of the rachi in the sagittal plane: lordosis and kyphosis and in the frontal plane: scoliosis (Wielki, 1979). The Radius Method was presented at the VIII Congress of ISB at Nagoya (Wielki, 1983) as a the method to measure the curves of the spine and a methodology of analysis of the spine. It was shown that the rachi's curve could be expressed in function of the radius instead of the angles.

## METHODOLOGY

In order to establish the value of the radius one needs only to apply the theorem of Pythagoras  $r^2 = (r-h)^2 + s^2$ , where  $r$  is the size of the radius of the curve,  $h$  is the height of the curve and  $s$  is the semi-cord of the curve (Wielki, 1983). Finally the method was improved, ten indexes were elaborated for "Normative Groups" formed of subjects of both sexes.



	Means of Norm. Gr.		
	♀	♂	
Dorso-Lumbar Index : $DLI = (AC : CB) \times 100$	209	222	(1)
Curve Relative Index : $ORI = (h1 : h2) \times 100$	168	239	(2)
Relative Summation Index : $RST = (S1 + S2) / (h1 + h2) \times 100$	9.8	9.9	(3)
Inc.Lumbar Index : $LI = (CI : AI) \times 100$	6.4	7.6	(4)
Dorsal Top Index : $DTI = (AF : FC) \times 100$	105	102	(5)
Dorsal Curve Index : $DCI = (h1 : AC) \times 100$	9.1	10.4	(6)
Radius Dorsal Curve : $RDC = (h1^2 + S1^2) : 2h1$	462mm	459mm	(7)
Lumbar Top Index : $LTI = (CG : GB) \times 100$	156	123	(8)
Lumbar Curve Index : $LCI = (h2 : CB) \times 100$	11.4	9.4	(9)
Radius Lumbar Curve : $RLC = (h2^2 + S2^2) : 2h2$	181mm	223mm	(10)

Figure 1. Means of indices of Normative Group.

## RESULTS and DISCUSSION

Applying the Improved Radius Method with Intersection Point on a Normative Group of 190 female and 282 male subjects, a Normative Typology was established. It was found that the relation between length of the dorsal curve to that of the lumbar curve and the relation between the heights of the curves were about two to one. Statistical analysis indicates about 82% of the sample presented the same relation as the means of the Normative Group. Therefore, curves with these characteristics were named Type "A" Normal. On the other 18%, 8% presented lower number in the relation they were named Type "B" Lordotic. The last 10% presented a higher number in the relation, they were named Type "C" Kyphotic.

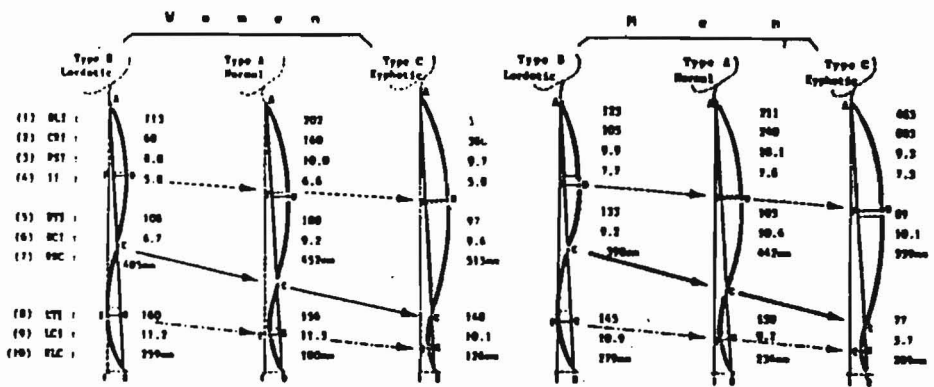


Figure 2. Normative Typology of anatomical rachi curves and their indices.

This typology states only facts; it is not intended to pass opinions. Its aim is to give a possibility to apply this method to different groups, to individuals, and to compare with the results obtained in other research centers. Experimental studies have shown that the most characteristic indexes are the: 1) DLI - relation between the length of the curves and 2) CRI - relation between the height of the curves. According to the aims of the study these two indices can generally be sufficient to record the changes in the spinal curve in consequence of a predominant sport or other human activity starting in the early youth.

Individuals Spherosomatograms showing the spine, part of the personal history of the efforts of children and top athletes to attain in a high performance level are presented hereafter. Figure 3 shows the individual Spherosomatograms of two children 1Ch and 2Ch, a top international male volleyball player 3VB M, a university champion backstroke male specialist 4BA M, and an Olympic medalist breaststroke swimmer 5BR F. Female (5BRa, 5BRb).

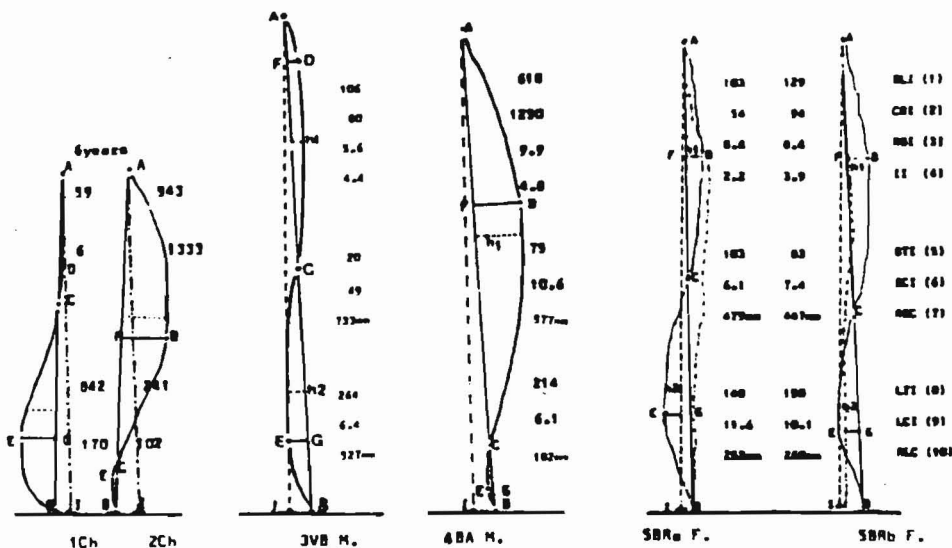


Figure 3. Samples of spheriosomatograms of selected athletes in different activities.

The means for children aged 6 are 198 for the relation of the length of the dorsal curve to the length of the lumbar curve DLI and 193 for the relation between the heights of the curves CRI. 1Ch has a DLI of 59 and CRI of only 6 is abnormally hyperlordotic. 2Ch has a DLI of 543 and a CRI 1933 which is enormous; he is hyperkyphotic. Those abnormal deformations witness abuses in exclusive sports activities chosen by children.

3VB M is major spiker of the Cuba team in the Junior World Championships. He is lightly Hyperkyphotic Type "C" with a DLI of 106 and a CRI of 80 with an extremely high position of Top D of the dorsal curve DTI close to the upper point A. Its DTI 20 compares with a mean of 133 in the Normative Group. The position, of the lumbar Top E LTI is close to the lowest point B of measurement of the spine.

4BA M is a hyperkyphotic with a DLI of 618 against 463 in the Normative Group Type Kyphotic "C". His CRI is 1250 against 803. The DTI is 75 against 89 and LTI is 214 against 77.

The spines of 3VB and 4BA are abnormal due to early and narrow specialization. The adaptation has become a deformation and thus this individual may not reach the optimum of their possibilities.

For 5BR F, the two spheriosomatograms on the sagittal and frontal planes made between the Olympic Games 84 and 88 show that 5BR lordotic evolves to Type Normal "A". The evolution was: DLI from 103 to 129; CRI from 54 to 94; DTI from 103 to 83; LTI from 148 to 150. On the frontal plane 5BRa shows a strong unilateral deviation to the right on the level of middle of the dorsal curve. The deviation diminishes slowly before nearly reaching point B, the lowest point of measurement. In 5BRb the deviation is less important. In the lumbar part it gets very close to the vertical ending nearly at point I. The lateral deviation was due to systematic turning on the same side in a small swimming pool (25 m), in order to follow the rules about turns for breast swimmers. The

improvement is due to certain adaptation of the training.

Spherosomatography enables one to detect the evolution of the spinal curves; it is a non-invasive method that can be used as often as necessary. It is useful for people who deal not only with children and youth sports, but also for top athletes. No sound interpretation, discovery and understanding of the exact causes of a deformation can take place without a good knowledge of the sport practiced by the subject. The spherosomatogram must be individually studied because each case and circumstances are different.

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