

**Comparative radiological study between cervical suspension to  
a third of the body weight and suspension on an inversion  
table.**

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The study of spontaneous reducibility of a scoliosis is undertaken via two methods; lateral inflexions in bending and cervical suspension as described by DU PELOUX (2).

This test allows for an evaluation of the relative residual stiffness by comparing the angle value in the frontal upright position with that of a total cervical suspension.

Essential in the X-ray examination, this technique remains unpleasant and very uncomfortable for the child.

Besides, DE MAUROY and FINE (1) have studied the possibility of eliminating the discomfort of a total suspension and recommend a suspension amounting to a third of the body weight.

We have been trying for a while to modify the cervical suspension and are now offering the possibility, to children, of a suspension by the feet on an inversion table.

Through a comparative analysis of the two methods, we intend to evaluate the frontal angulations and the vertebral rotation on the two X-rays in order to appreciate which of the two protocols offers the best results.

## EQUIPMENT AND METHOD

### 21. STUDY POPULATION

The sample is made up of 28 patients with scoliosis, 23 of whom are girls and 5 are boys, with an age range of 11 to 17. The study of the anatomic X-ray reveals:

- 14 thoracic
- 9 lumbar vertebrae
- 5 thoraco-lumbar vertebrae

### 22. EQUIPMENT

#### 221. The inversion table

It consists of a frame in the shape of “crossbar and stands,” and a cradle supporting a plate. The cradle rotates around a median axle located at the top of the frame. The child has full posterior support on the plate, from head to buttocks, the plate being moveable on the cradle. A wooden frame is fixed to the plate with straps and a system of upper and lower safety catches. It is made of two crossbars which are adjustable in height, allowing for the X-ray plate. A metal bar goes all the way to a footrest adjustable for heights between 150 and 200 cm. Leg lock features are enabled by a self-blocking device. The locking of the table in various inversion positions is permitted through a system controlled by the child.

#### 222. Radiological installation

X-rays are taken with a distance between focus and film of two metres. One uses a 30x90 cassette with a grid equipped with progressive screens (T.G.GRADUAL. 3 M TRIMAX).

## 23. METHODOLOGY

### 231. Cervical suspension to a third of the body weight

This is done with the help of a SAYRES' halter, holding the chin and occipital bone; the end strand of a hoist is attached to the beam, the initial strand is held by the radiologist. One checks that the hoist is placed vertically in relation to the child and that the radiographic plate is parallel to the child's frontal plane. The patient is weighed, an operator pulls the hoist and brings the pointer of the scales to the requested values (one third of the body weight), and the X-ray image is taken.

### 232. Suspension by the feet on the inversion table

The child is barefoot in order to obtain total efficiency of the self-blocking system. He lies with his upper body from the head all the way to the buttocks on the radiographic table, which is attached to the plate with the help of the frame. The child puts himself in the inverted position at a 30° angle for 30 seconds, then at a 60° angle for 30 seconds, thus getting used to the handling of the table, then two minutes at an 80° angle, and finally two minutes in complete inverted position. The total time is 5 minutes at the end of which the X-ray image is taken.

## RESULTS

### 31. SLOPE

The estimation of the slope values in the frontal plane is carried out following the method described by COBB. The whole set of results is displayed in table 1.

The transfer of these values onto an orthonormal coordinate system (x, y) reveals a cluster of points which allows us to interpolate a linear regression.

The average slope values in the three positions are presented in table 2.

### 32. ROTATION

We have assessed the vertebral rotations in view of the apical vertebrae using the RAIMONDI device which provides a direct reading of rotatory values. The whole set of results can be found in the table. Subsequently, we have tried to establish statistical links between the different positions.

## DISCUSSION

The relatively low number of cases does not allow us to draw general conclusions. With regards to the frontal angulation, the correlation coefficients which are always greater than 0.8, allow us to consider several observations, relevant to our specific framework.

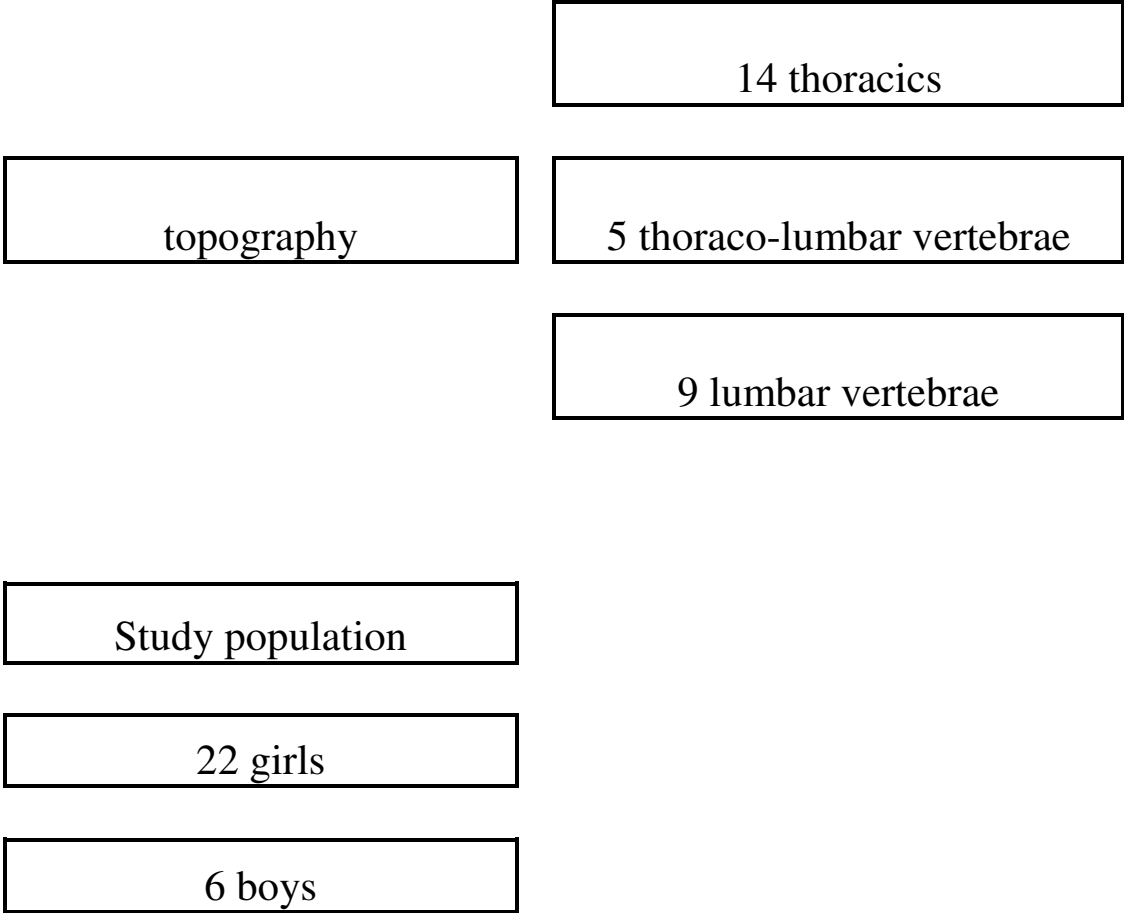
On the one hand, the gains obtained with the inversion table are greater than those obtained by cervical suspension to a third of the body weight. Besides, it appears that lumbar and thoraco-lumbar scoliosis respond more favourably than thoracic scoliosis (table 2). Our results on the inversion table and more particularly those concerning lumbar scoliosis can be superimposed on those recorded in total cervical suspension (FINE et al.).

On the other hand, as far as the vertebral rotation is concerned, mediocre correlation coefficients do not allow us to draw any statistical conclusions.

For the scoliotics who have “benefited” from both examination methods, and once the disconcerting feeling of being put on the inversion table disappears, teenage girls appreciate and indeed prefer this type of examination; the setting up is progressive, sometimes fun and always very comfortable.

## BIBLIOGRAPHY

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2. PELOUX J. (du) – Étude de la réductibilité spontanée des scoliozes structurales par la radiographie en suspension verticale. Ann. Med. Phys., 1971, 14, 215-233
3. STAGNARA P. – Radiologie des déformations vertébrales : les scoliozes. E.M.C, Radiodiagnostic, 1969, 31131 A-10, A-20, A-30.



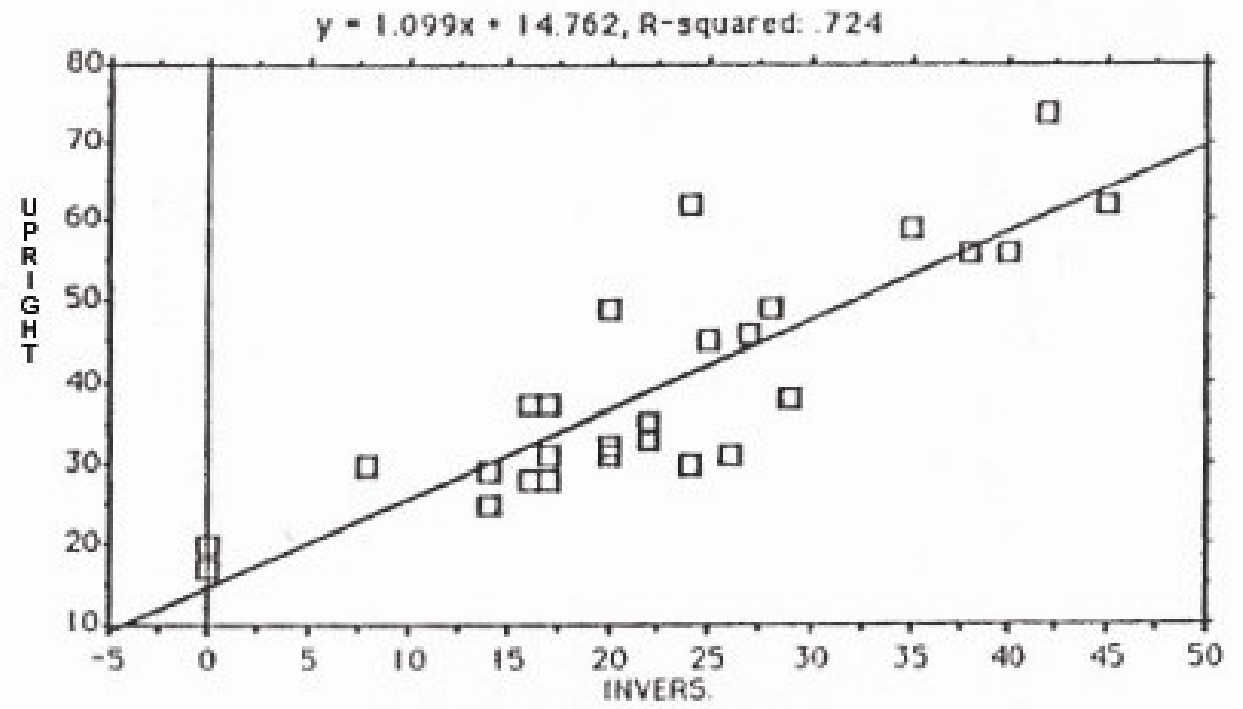
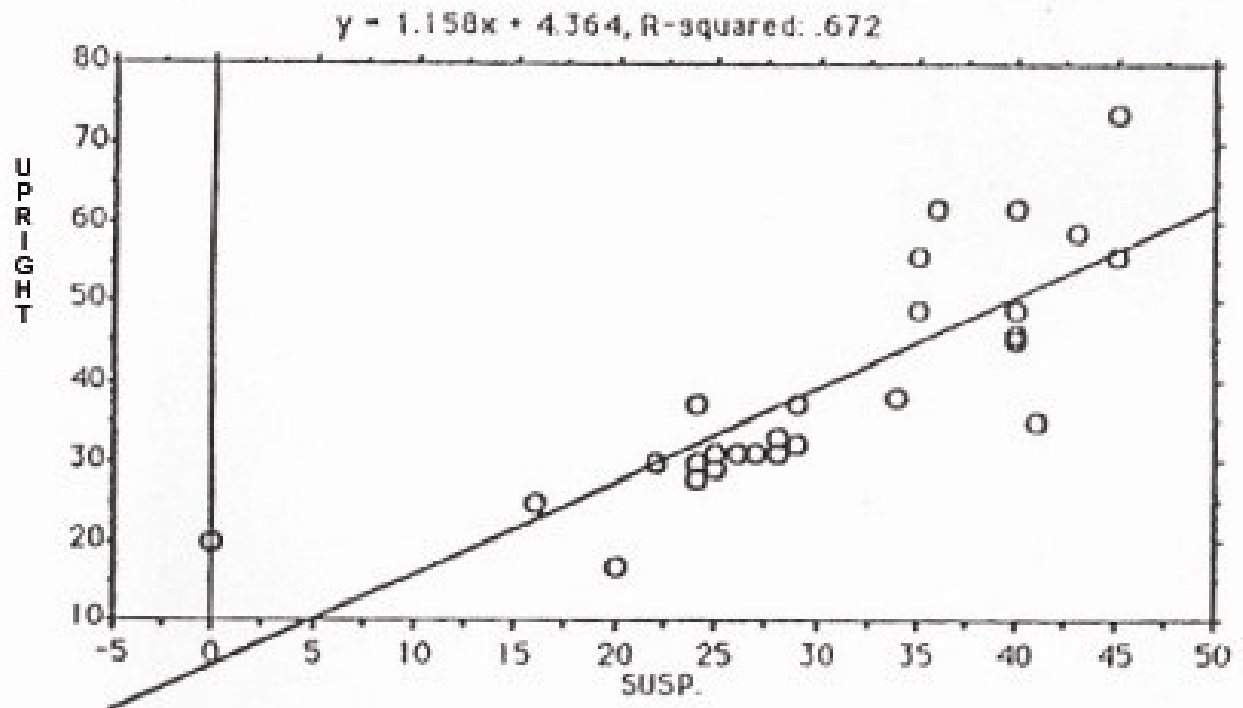
Correlation Matrix for Variables: X1...X3

	Upright	Susp.	Inverted
Upright position	1		
Suspended position	0.82	1	
Inverted position	0.851	0.82	1

Correlation Matrix for Variables: X1...X3

	Tors. upright	Tors. susp.	Tors. inv.
Torsion upright position	1		
Torsion suspended position	0.714	1	
Torsion inverted position	0.748	0.693	1

Note: 4 cases deleted with missing values.



## Assessment of the frontal angulation

	Minimum	Average	Maximum
Upright pos.	17°	39°	74°
1/3 suspended	0	30°	45°
Inverted pos.	0	22°	45°

## Assessment of torsion

	Minimum	Average	Maximum
Upright pos.	0	14°	35°
1/3 suspended	0	13°	30°
Inverted pos.	0	12°	25°