Changes In The Vertebral Growth Plate After Surgical Correction Of Scoliosis In Animal Model.

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conflict of interest disclosure

There is no conflict of interest for any author

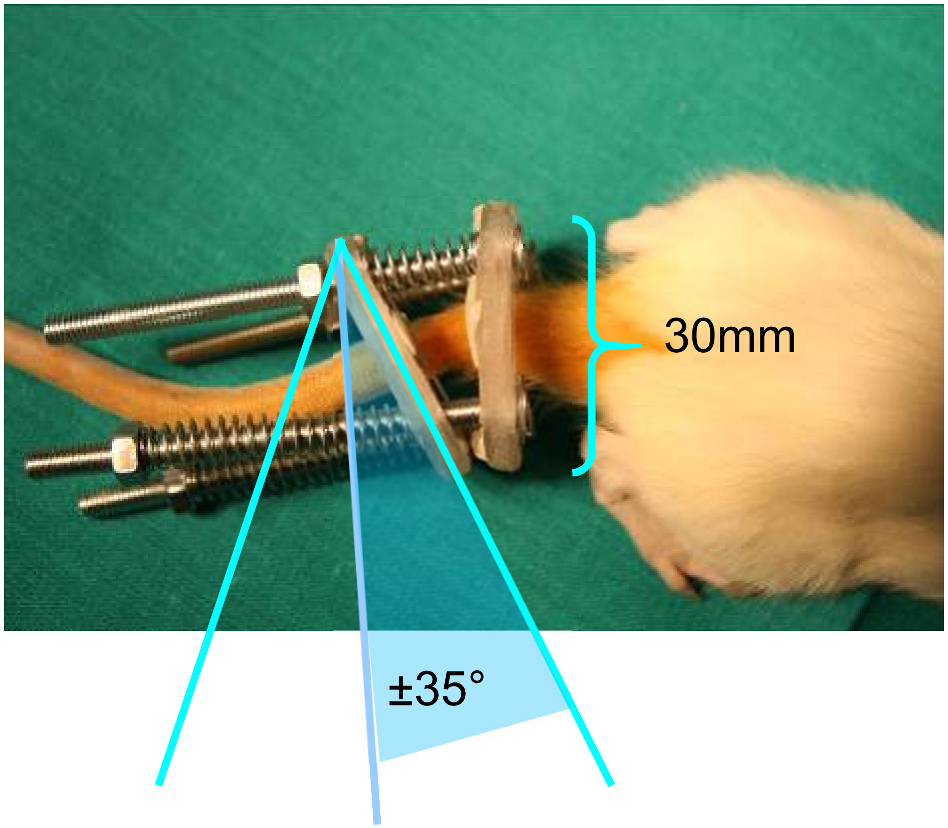
Mechanical stress affect bone growth

Aim:

What are the possibilities of reconstruction
of the deformed vertebrae on the apex of the curvature after the correction?

Material i method

49 day old rets weight 119-127 g (mean 125g)
24 animals



External fixator

composite materials

stainless steel wires ø 0,5mm

Stokes IA, Spence H, Aronsson DD, Kilmer N. Mechanical modulation of vertebral body growth. Implications for scoliosis progression. Spine. 1996; 21:1162-7.

Mente PL, Aronsson DD, Stokes IA, Iatridis JC. Mechanical modulation of growth for the correction of vertebral wedge deformities. J Orthop Res. 1999; 17:518-24.

49 d.o.
Day 0

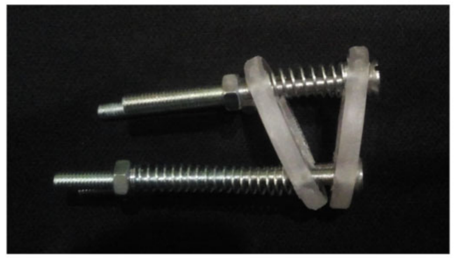
4 animals → His-pat → Control (Group I)

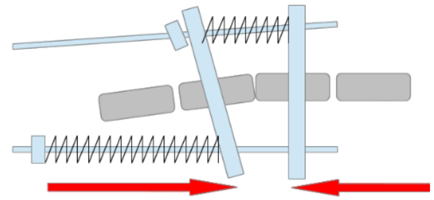
device implanted in the remaining 20 animals

Stage I

Springs

load 0,2 MPa





Wedge deformation of the vertebra

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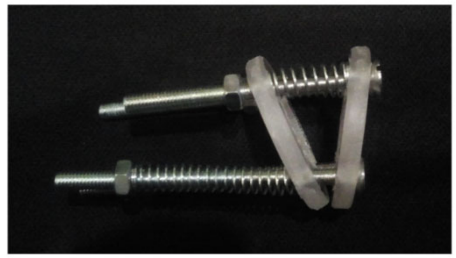
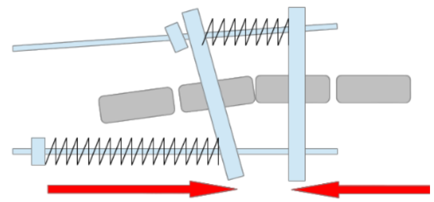


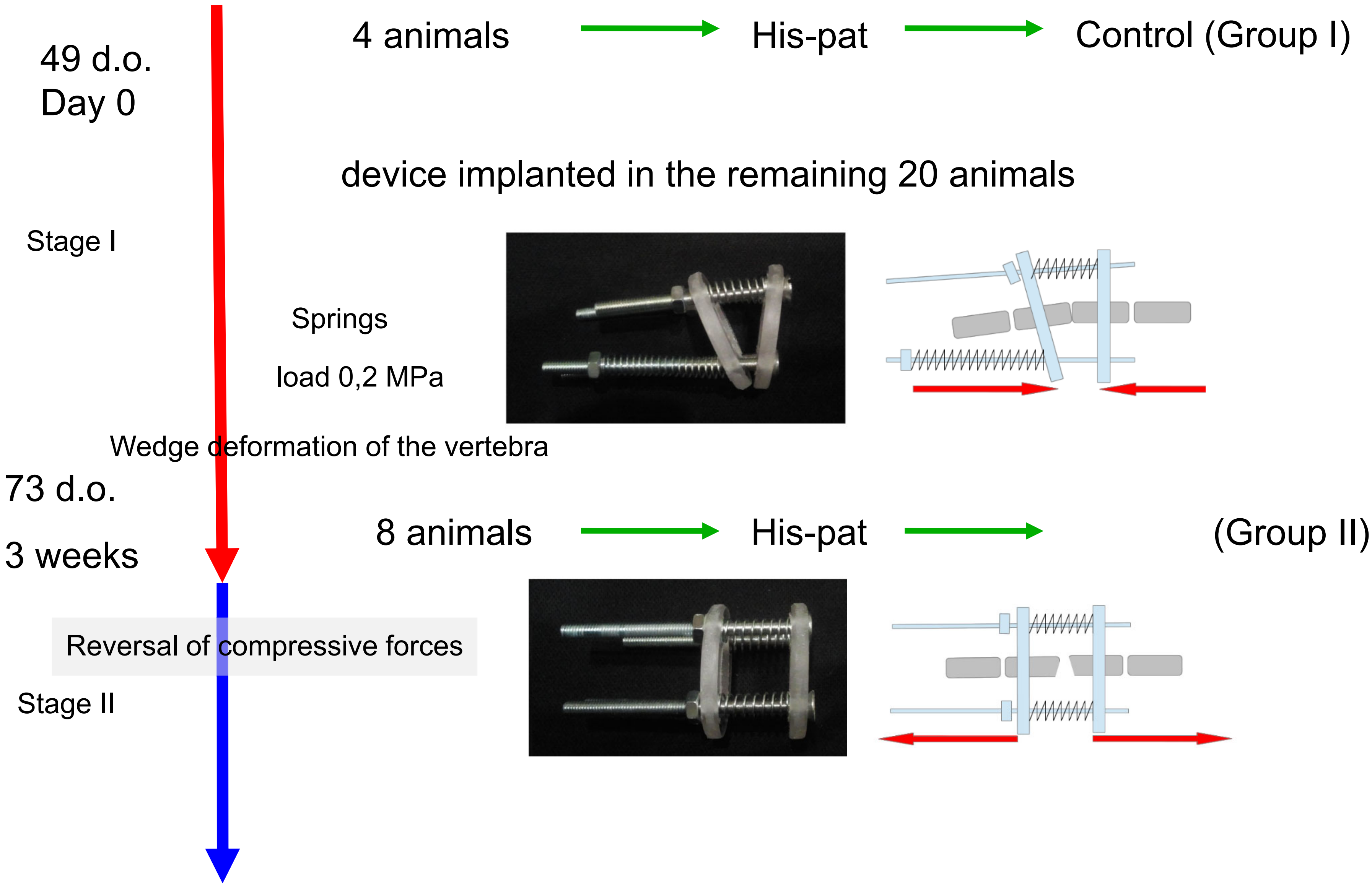


Wedge deformation of the vertebra

73 d.o.

3 weeks

8 animals → His-pat → (Group II)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Wedge deformation of the vertebra
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8 animals
His-pat
(Group II)
Reversal of compressive forces
Stage II

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Stage I

Springs

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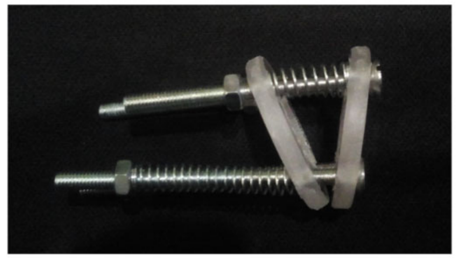

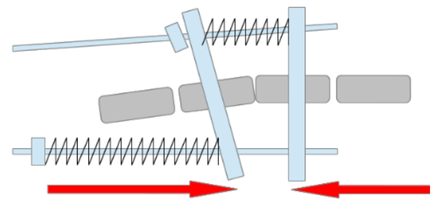

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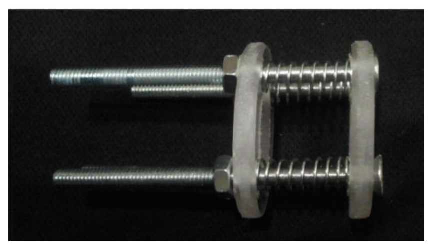
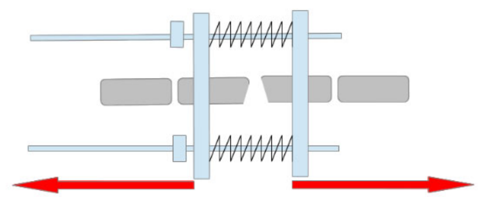




94 d.o.

6 weeks

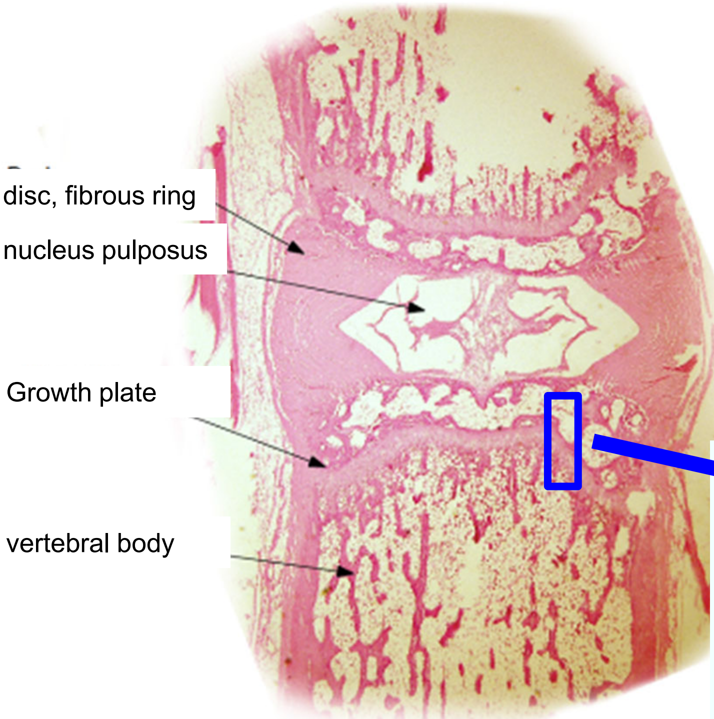
7 animals → His-pat → (Group III)

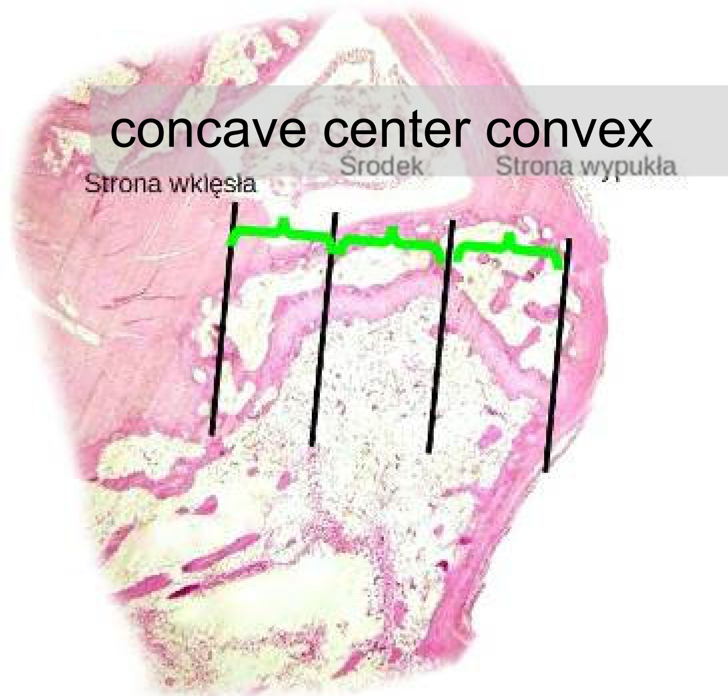
End of experiment

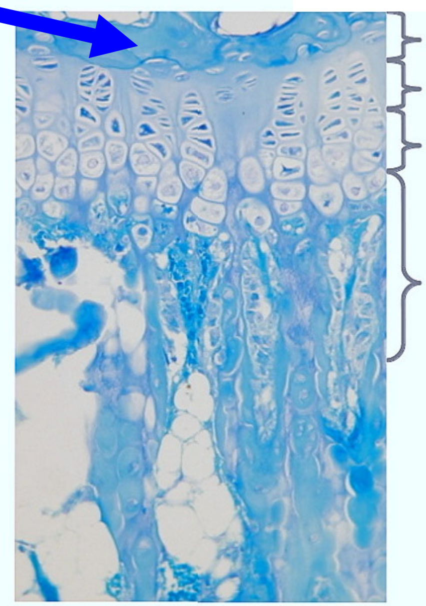
The control group of each group - vertebrae without stabilizator

histological examination

Preparations were cut in the frontal plane







thickness

end plate

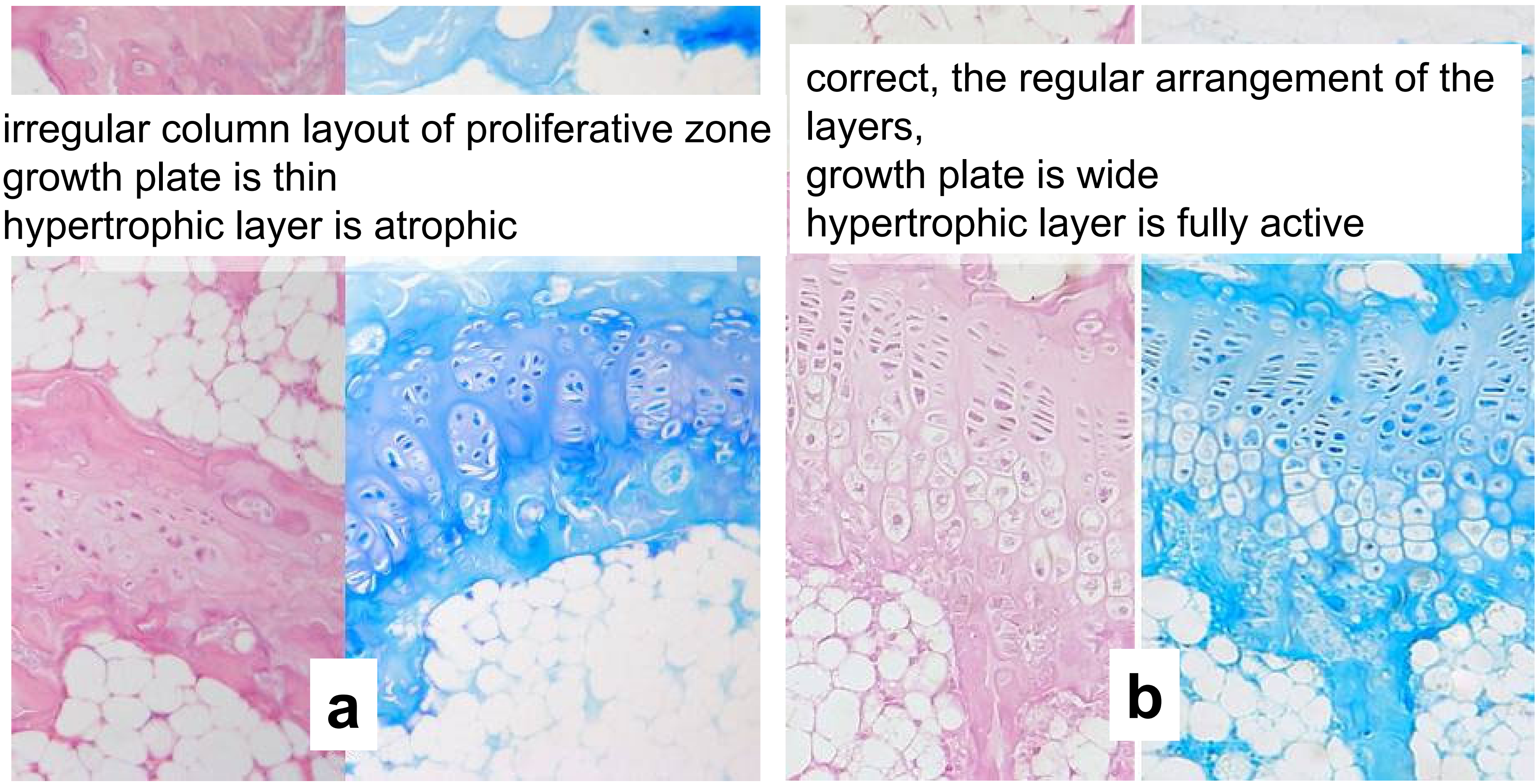
hypertrophic zone

chondrocytes

Results

Histopathology: Group II (formed scoliosis) cartilage from the concave (a), and control group (b)

Staining of H + E and Methyl blue 200x.



the height of the **growth plate**, **chondrocytes** and **hypertrophic zones** in all research groups (in microns)

	Group I	Group II				Group III			
thicknes	Control day0	After 3 weeks- skoliozis =0+3weeks			Control after 3 weeks = 0+3tyg	next 3 weeks- after correction =0+3+3tyg			next 3 weeks =0+3+3tyg
		concave	center	convex		concave	center	convex	
end plate	215.9	80.9	112.1	108.5	155.2	127.7	135.5	153.4	131.4
SD	9.6	22.1	8.2	11.6	14.0	8.3	5.7	10.6	9.4
hipertrofic zone	93.5	27.9	57.2	62.6	85.3	69.0	74.9	79.1	84.7
SD	3.1	3.6	5.2	7.4	6.0	7.9	6.3	15.5	8.3
chondrocytes	19.3	10.3	14.0	18.6	24.8	20.2	21.5	23.8	22.2
SD	4.7	1.4	2.2	1.4	3.3	3.1	1.7	5.5	2.4

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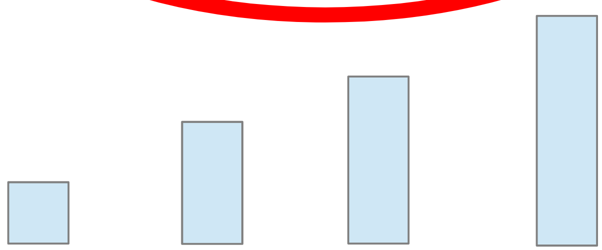

In the II'nd group was the most **reduced** height of hypertrophic zone and condrocytes **on compression-side** (p <0.001) compared with the control the height of the growth plate, chondrocytes and hypertrophic zones in different all groups (in microns)

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After 3 weeks of **correction** - **increase** the **activity** of the structures over the entire width **of the growth plate** - thickening.

Hypertrophic chondrocyte layer and the concave side doubled its height (p <0.001).

the height of the growth plate, chondrocytes and hypertrophic zones in different all groups (in microns)

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After the experiment, the height of chondrocytes on the entire width of the cartilage **did not differ** from those in the **control group** ($p > 0.05$).
End plate thickness after correction corresponds to the control group.

the height of the growth plate, chondrocytes and hypertrophic zones in all research groups (in microns)

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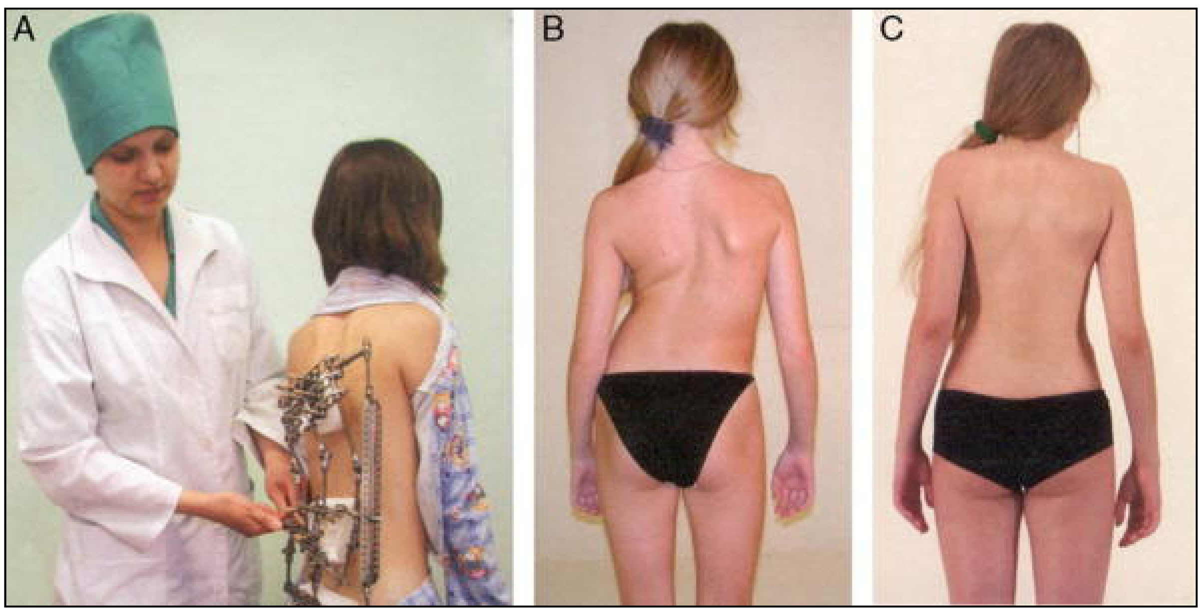
None of the evaluated elements was **activated on the convex** side of the curvature - distraction forces
relative to the control group (p <0.001)

Conclusions

1. Starting early correction of scoliosis with **strain relief of compressed** end-plate allows the return of the **physiological activity** of the growth and rebuilding of deformed vertebral body.

Conclusions

2 Results may be an interesting starting point to **consider** the possibility to **remove** stabilization **without SF** after GGS treatment.



From Russian Ilizarov Scientific Centre
"Restorative Traumatology and Orthopaedics"

Nonfusion Treatment of Adolescent Idiopathic Scoliosis by Growth Modulation and Remodeling.
Aronsson, David; Stokes, Ian

Journal of Pediatric Orthopaedics. 31 Number 1 Supplement:S99-S106, January/February 2011.
DOI: 10.1097/BPO.0b013e318203b141

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