

GEOMETRICAL RISK FACTORS FOR LOW- GRADE SPONDYLOLISTHESIS AND THE ESTABLISHMENT OF SLIP ON LATERAL X-RAYS

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Disclosure

- None of the authors had a conflict of interest.



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Introduction

- Degree of slip in spondylolisthesis is important for clinical decision making
- Controversy about exact measurement and definition of slip¹
- Several geometrical risk factors for degenerative spondylolisthesis are established²



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1. Bourassa-Moreau 2010; McCarty 2009
2. Ikata 1996; Tsirikos 2010; Labelle 2005; Roussouly 2006

Aims of the study

- Difference in geometrical risk factors between controls, grade I and grade II slip?
- Pseudospondylolisthesis¹: difference in anterior and posterior slip?
- Will a combination of geometrical risk factors further increase the risk?



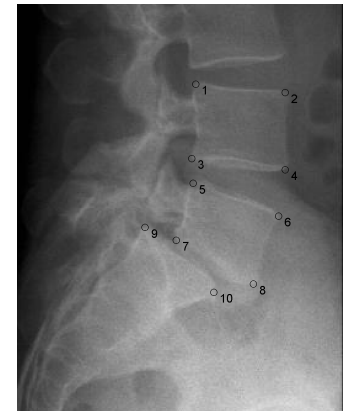
Study design

- Case-control study
 - 44 patients: grade I or II spondylolisthesis at level L5-S1, >16 years (Table 1)
 - 180 controls: no physical or radiological defects
- Standing lateral lumbar X-rays
 - Identification of 10 objective landmarks based on method of Frobin¹ (Fig 1)

Table 1. Overview patients

	L5-S1
Grade I	25
Grade II	19
Total	44

Fig 1. Landmarks on X-ray



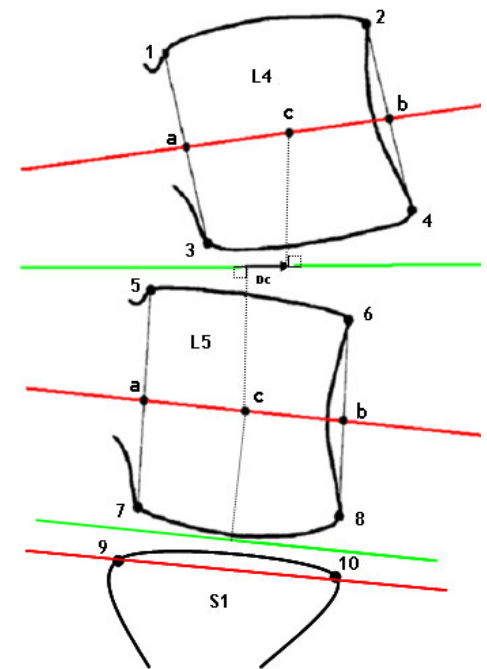
1. Frobin. Clin Biomech. 1996



Outcome measures

- Anterior and posterior slip
 - perpendicular projection of points 7-10 on bisectrice of L5 and S1
- Diameter ratio
 - Length a-b upper vertebra / length a-b lower vertebra
- Wedging L5
 - $\frac{((\text{distance } 6-8) - (\text{distance } 5-7))}{((\text{distance } 6-8) + (\text{distance } 5-7))}$
- Sacral slope
 - angle between endplate of S1 and horizontal line

Fig 2. Schematic overview of landmarks used for calculation of outcome measures



Analyses

- ANOVA for geometrical risk factors and degree of slip
 - Compare groups: control – grade I – grade II
- Multivariate logistic regression
 - Risk factors: Odds Ratio (OR)



Results – 1

- All outcome measures significantly different from control group

Table 2. Mean and standard deviations of the outcome measures of the control group and patients with spondylolisthesis at level L5-S1

	Control (n=180)	Grade I (n=25)	Grade II (n=19)
Anterior slip L5-S1*	-0.03 (0.04)	0.12 (0.07)	0.21 (0.08)
Posterior slip L5-S1*	-0.023 (0.05)	0.19 (0.07)	0.30 (0.09)
Ratio L5/S1#	1.00 (0.03)	0.97 (0.04)	0.96 (0.03)
Wedge L5#	0.068 (0.040)	0.14 (0.047)	0.14 (0.066)
Sacral slope (°)#	36.8 (10.3)	47.3 (8.8)	49.8 (10.2)

Posterior slip > Anterior slip

No differences between grade I and grade II

*significantly different between all groups

#significantly different between control group and grade I and control group and grade II



Results – 2

- Risk factors included in regression model

Table 3. Characteristics of the parameters of the multivariate logistic regression model

Parameter	Coefficient	Coefficient Normalized data	Explained variance (R ²)	Odds Ratio
Wedge L5	22.77	1.17	0.31	3.23
Ratio L5/S1	-30.87	-0.99	0.37	0.37
Sacral slope (°)	0.079	0.87	0.41	2.39



Conclusion

- Large wedge L5, high sacral slope, and small ratio L5/S1 increased the risk for a spondylolisthesis
 - no influence of the grade of slip
 - combination of factors further increases the risk
- Pseudospondylolisthesis confirmed



Conclusion

Consistence and standardization of slip measurement and geometrical properties of the vertebrae are very important in the assessment and progression of interventions in low-grade spondylolisthesis



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