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Portland

# Return to activity in AIS after fusion and non- fusion Spine Surgery

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# Disclosures

- None related to this talk
- Speaker:
  - Depuy Synthes
  - Nuvasive Spine
  - Orthopediatrics
  - Stryker Spine
  - Zimmer Spine
- Advisory board:
  - Depuy Synthes
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  - Stryker Spine
  - Zimmer Biomet
  - Astrozenica
- Member:
  - SRS
  - POSNA
  - PSSG
- Grant Recipient:
  - POSNA
  - Shriners Hospital for Children
  - Zimmer Biomet



# Objectives

- Impact of construct type on return to sport
- Impact of LIV on return to sport
- Why delay return to sport

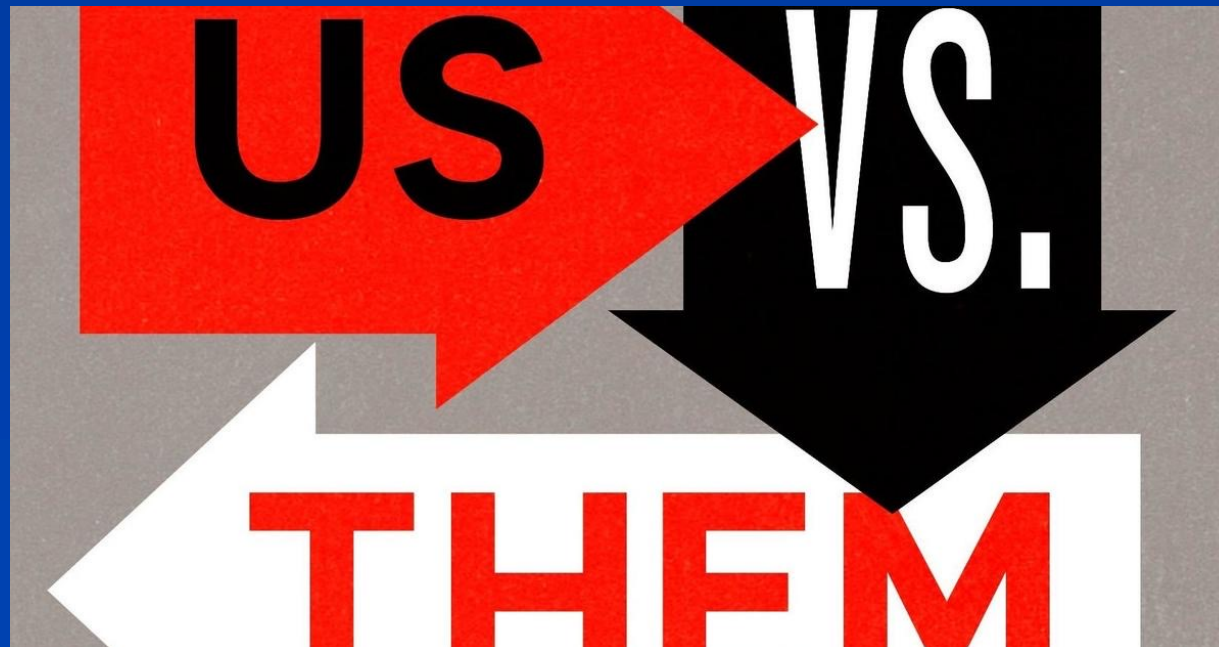


# Sport Examples in Adolescents

Noncontact	Noncontact twisting	Contact/collision
Jogging/running/sprinting/XC	Hurdles	Soccer
<b>PE/gym class</b>	Gymnastics	Basketball
Cycling	Racquet sports (tennis, squash)	Lacrosse
Rowing	Golf	Football
Weightlifting	Volleyball	Wrestling
Horseback riding	Swimming	Hockey
	Skiing	Rugby
	Figure skating	Mixed martial arts
	Baseball/softball/cricket	Gymnastics
	Yoga/pilates	
	Cheerleading	
	<b>Trampoline</b>	
	Monkey bars	

Many never return to  
sport...

Is it us or is it them



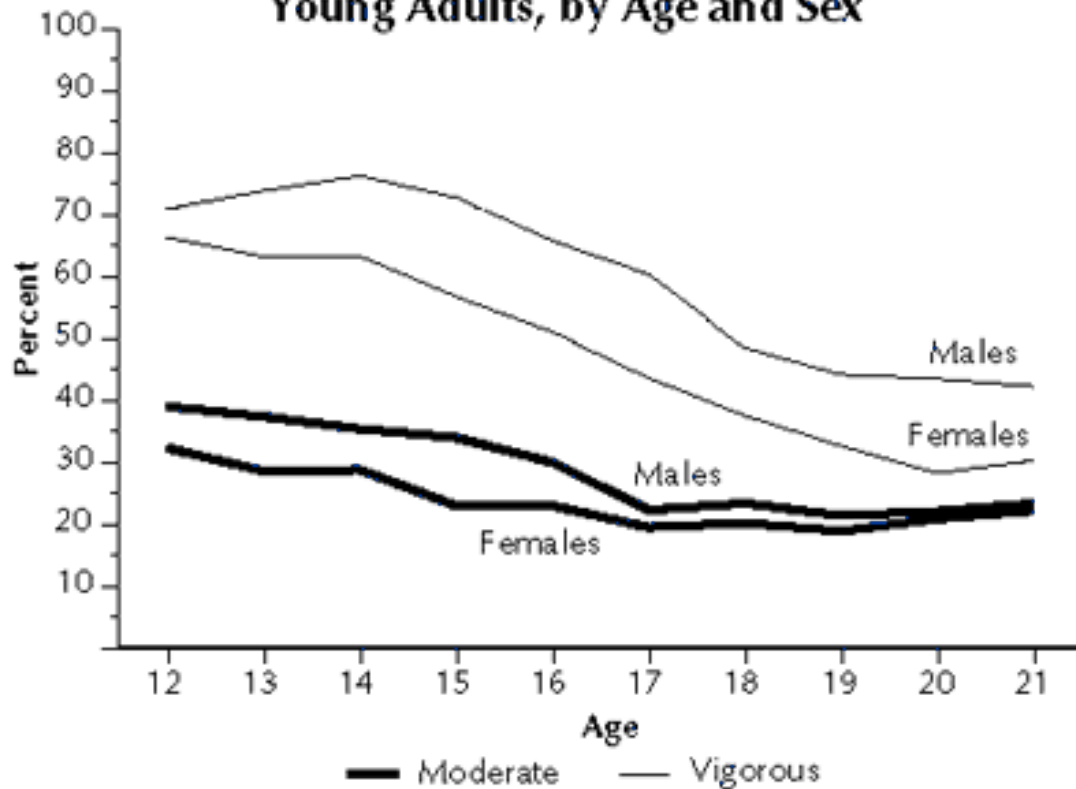
Them: Many choose  
to not go back

A Report of the Surgeon General

## Physical Activity and Health

*Adolescents and Young Adults*

**Physical Activity Levels of Adolescents and Young Adults, by Age and Sex**



Source: CDC 1992 National Health Interview Survey Youth Risk Behavior Survey

Participation in all types of physical activity declines strikingly as age or grade in school increases

# Them: Many never get back to sport... Why?

Return to sport after posterior spinal fusion for adolescent idiopathic scoliosis: what variables actually have an influence? A retrospective study

Alberto Ruffilli<sup>1</sup> · Francesca Barile<sup>1</sup> · Giovanni Viroli<sup>1</sup> · Marco Manzetti<sup>1</sup> · Matteo Traversari<sup>1</sup> · Marco Ialuna<sup>1</sup> · Bartłomiej Dobromir Bulzacki Bogucki<sup>1</sup> · Cesare Faldini<sup>1</sup>

- 76 (67.8%) patients RTS  $\geq$  preop level
- RTS associated with:
  - Younger age
  - Lower Lenke curve type
  - Smaller major Cobb

Reasons for NRTS	No of patients (n=36)	Activity	Preoperative (n patients)	Last follow-up (n patients)
		None	–	15
		Swimming	40	44
Stiffness	15	Ballet	44	4
Deconditioning	2	Gym	32	60
Pain	1	Volleyball	8	0
Loss of desire	6	Cycling	4	4
Schedule problems	4	Tennis	4	0
Fear of injury	3	Horseback riding	4	4
Parents or pediatrician suggestion	9	Skating	4	0
		Handball	4	4
		Running	4	4
		Soccer	4	0
Some patients played more than 1 sport				
n number				

Return to Athletic Activity After Posterior Spinal Fusion for Adolescent Idiopathic Scoliosis: Analysis of Independent Predictors

Peter D. Fabricant, MD, Sha-har Admoni, BS, Daniel W. Green, MD, Lisa S. Ipp, MD, and Roger F. Widmann, MD

- 25 (59.5%) patients RTS  $\geq$  preop level
- RTS associated with:
  - More distal LIV
  - Lenke classification
  - Final SRS-22 score

TABLE 1. Frequency of Self-reported Primary and Contributing Reasons for Decline in Athletic Activity for 17 Patients Who Did Not Reach Preoperative Activity Level

Reason for Decline in Athletic Activity	Primary	Contributing
Loss of flexibility	8 (47%)	10
Back pain	4 (23.5%)	9
Deconditioning	3 (17.5%)	4
Loss of desire	1 (6%)	4
Scheduling	1 (6%)	4
Total	17	

Sport/Activity	Preoperative Participants (All Subjects)	Postoperative Participants (Same Level or Better Group)
Tennis	6	5
Softball	5	4
Basketball	5	2
Gymnastics/cheerleading	5	1
Soccer	4	2
Recreational	4	0
Ballet	3	1
Volleyball	2	1
Swimming	2	3
Lacrosse	1	1
Hockey	1	0
Track	1	1
Frisbee	1	1
Pilates	1	1
Karate	1	1
Skiing	0	1
Total	42	25

# Us: Significant variability in Surgeon recommendations

Return to sports after surgery to correct adolescent idiopathic scoliosis:  
a survey of the Spinal Deformity Study Group

Ronald A. Lehman, Jr., MD<sup>a,b,\*</sup>, Daniel G. Kang, MD<sup>a</sup>, Lawrence G. Lenke, MD<sup>b</sup>,  
Daniel J. Sucato, MD<sup>d</sup>, Adam J. Bevevino, MD<sup>a</sup>, and the Spinal Deformity Study Group

- Most patients allowed to return to:
  - 3 months: Running
  - 6 months: noncontact and contact sports
  - 12 months collision sports
- 20% never allow return to collision sports
- More distal LIV resulted in more surgeons never allowing return to collision sports:
  - 12% for STF
  - 33% for PSIF to L4

## Athletic Activity After Spine Surgery in Children and Adolescents

Results of a Survey

Paul T. Rubery, MD,\* and David S. Bradford, MD†

Variable	"Not at All" (%)	"Slightly" (%)	"Moderate" (%)	"Great Deal" (%)	No Answer (%)
Use of instrumentation	9	12	24	53	2
Clinical progress	4	19	41	34	4
Radiographic appearance	12	30	28	27	3
Distal fusion level	19	32	26	18	4
Time from surgery	2	1	17	79	1
Age	20	31	32	13	3
Chosen sport	8	16	35	38	3
Surgeon's habit	9	18	42	27	4

Data are presented as percent of respondents.

**Table 3. Surgeon's Preference for Return to Sport in Patients After Scoliosis Fusion**

Activity	Immediate (%)	6 Weeks (%)	12 Weeks (%)	4 Months (%)	6 Months (%)	1 Year (%)	2 Years (%)	Recommend Against (%)	Never (%)
Physical therapy	32	24	27	N/A	13	5	N/A	N/A	N/A
Gym class	1	1	5	8	38	44	N/A	N/A	2
Low-impact, noncontact	2	8	15	17	43	15	N/A	N/A	0
Noncontact	0	1	8	8	46	34	N/A	1	0
Contact	0	0	1	3	20	61	1	11	2
Collision	0	0	0	0.3	6	32	1	36	24

Data are presented as percent of respondents.

N/A, indicated response was not available for that specific question.



# What and when do they return too?

## When Do Patients Return to Physical Activities and Athletics After Scoliosis Surgery?

A Validated Patient Questionnaire Based Study

Vishal Sarwahi, MD,\* Stephen Wendolowski, BS,\* Rachel Gecelter, BS,\* Kathleen Maguire, MD,†  
Melanie Gambassi, cPNP,\* Dana Orlando,† Yungtai Lo, PhD,‡ and Terry Amaral, MD\*

**TABLE 2. Time to Return to School and School-related, and Physical Activities**

	Less than 1 Month, N (%)	1–3 Months, N (%)	4–6 Months, N (%)	7 Months–1 Year, N (%)	Over 1 Year, N (%)
School, N = 93	6 (6.4)	66 (71)	17 (18.3)	4 (4.3)	0 (0)
Gym, N = 81	2 (2.5)	28 (34.5)	31 (38.3)	18 (22.2)	2 (2.5)
Carry backpack, N = 93	2 (2.1)	46 (49.5)	35 (37.6)	10 (10.8)	0 (0)
Bend over, N = 90	2 (2.1)	52 (57.8)	24 (26.7)	10 (11.1)	2 (2.1)
Running, N = 87	0 (0)	37 (42.5)	33 (37.9)	16 (18.4)	1 (1.2)

**TABLE 3. Distribution of the Population's Athletic Activity and Time to Return to the Activity**

Participation	Noncontact, N (%)	Contact, N (%)	Collision Sports, N (%)	Biking, N (%)
Yes	50 (52.6)	33 (34.7)	8 (8.4)	30 (31.6)
No	44 (46.3)	61 (64.2)	86 (90.5)	60 (63.2)
N/A	1 (1.1)	1 (1.1)	1 (1.1)	5 (5.2)
Return Time	Noncontact	Contact	Collision Sports	Biking
1–3 months	13 (26)	8 (24.2)	0 (0)	5 (16.6)
4–6 months	14 (28)	13 (39.4)	3 (37.5)	11 (36.7)
7 months–1 year	18 (36)	11 (33.3)	4 (50)	11 (36.7)
Over 1 year	4 (8)	1 (3.0)	0 (0)	2 (6.7)
Did not return	1 (2)	0 (0)	1 (12.5)	1 (3.3)

**TABLE 4. Time to Return to Preoperative Level**

Return to Preoperative Level	Noncontact N = 49	Contact N = 33	Collision N = 6
Yes, N (%)	29 (59.2)	26 (78.8)	5 (83.3)
No, N (%)	20 (40.8)	7 (21.2)	1 (16.7)
Return Time	Noncontact	Contact	Collision
1–3 months	8 (27.6)	6 (23.1)	0 (0)
4–6 months	8 (27.6)	9 (34.6)	2 (40)
7 months–1 year	10 (34.5)	10 (38.5)	3 (60)
Over 1 year	3 (10.3)	1 (3.8)	0 (0)

- AIS patients can expect to RTS:
  - 1/4 by 3 months
  - > 1/2 by 6 months.
- Students who delayed their return to school and gym:
  - higher BMI
  - fusion to L3 or L4
  - Older age
  - Preop Cobb >70

# Timing and Predictors of Return to Short-term Functional Activity in Adolescent Idiopathic Scoliosis After Posterior Spinal Fusion

A Prospective Study

Roslyn C. Tarrant, PhD,\*\*† Padhraig F. O’Loughlin, MD, MRCS,\* Sam Lynch, MB, BCH, BAO, MRCSI,\* Joseph M. Queally, MD, FRCS (Tr & Orth),\* Padraig Sheeran, DA DTM&H, FFARCSI, FRCSEd, FFSEM, FJFICMI,‡§ David P. Moore, MCh ORTH, FRCSI, (Tr & Orth),\*§ and Patrick J. Kiely, MB, BCH, BAO, FRCSI, FRCSI (Tr & Orth)\*§

- The majority of patients with AIS can expect to return to:
  - School/college full-time by 16 weeks
  - Unrestricted physical activity by 52 weeks
- Delayed return to school/college full-time was associated with:
  - Preoperative curves greater than 70 °
  - Postoperative weight loss >5 kg,
  - Minor perioperative respiratory complication

# What and when do they return too?

TABLE 2. Return to School/College and Physical Activity Statistics

Statistic	School/College Return (wk)		Physical Activity (wk)	
	Part-time*	Full-time†	Part-time‡	Unrestricted§
	n = 57	n = 75	n = 74	n = 70
Median	6	10	11.5	24
25th percentile	4	6	6	16
75th percentile	6.4	16	16	32

\*Defined as half days; n = 20 excluded cases (for details on exclusions, refer to "Results" section).

†Defined as full days; n = 2 excluded cases who did not attend school/college preoperatively.

‡Includes low-impact, noncontact, noncompetitive recreational physical activity greater than walking, as per the patient's preoperative level or better, including gentle swimming, jogging, cycling, yoga, Pilates; n = 3 excluded subjects who never participated in part-time physical activity preoperatively.

§Includes contact sports and competitive athletic activity, as per the patient's preoperative level or better; n = 7 excluded cases who never participated in unrestricted or "any" physical activity greater than walking preoperatively; of the 70 eligible cases, there were n = 3 missing values of those who did not return to unrestricted physical activity during the study.

TABLE 4. Relative Risks for Factors Predictive of Delayed Return to School/College Full-Time (> 16 wk) Using Binary Logistic Regression Analysis (n = 75)\*

Independent Factor	Multivariate Model†		
	RR	95% CI	P
Preoperative curve severity: >70°	3.38	1.55–4.23	0.008
Weight loss during the hospital stay: >5 kg	3.02	1.37–4.22	0.012
Minor perioperative respiratory complication incidence‡	2.89	0.7–5.03	0.024

\*The independent variables were dichotomized as follows: preoperative curve severity (≤70° vs. >70°); weight loss during the hospital stay (≤5 kg vs. >5 kg) where 5 kg corresponds to the 75th percentile of the continuous weight loss variable (equivalent to 10% weight loss in the sample); and minor perioperative respiratory complications experienced (yes vs. no).

†The model is adjusted for age at surgery and hospital site.

‡For details on specific perioperative respiratory complications, refer to Table 1.

RR indicates relative risk; CI, confidence interval.

Can bad things happen?

WHY DO  
**BAD**  
THINGS HAPPEN TO  
**GOOD**

*Spine Surgeons*

# What Bad Things Can Happen?

Return to sports after surgery to correct adolescent idiopathic scoliosis: a survey of the Spinal Deformity Study Group

Ronald A. Lehman, Jr., MD<sup>a,b,\*</sup>, Daniel G. Kang, MD<sup>a</sup>, Lawrence G. Lenke, MD<sup>b</sup>, Daniel J. Sucato, MD<sup>d</sup>, Adam J. Bevevino, MD<sup>a</sup>, and the Spinal Deformity Study Group

Athletic Activity After Spine Surgery in Children and Adolescents

Results of a Survey

Paul T. Rubery, MD,\* and David S. Bradford, MD†

Getting Them Back in the Game: When Can Athletes With Adolescent Idiopathic Scoliosis Safely Return to Sports? A Mixed-effects Study of the Pediatric Orthopaedic Association of North America

Dedi Ho, BS, Jerry Y. Du, MD, Mehmet Erkilinc, MD, Michael P. Glotzbecker, MD, and R. Justin Mistovich, MD, MBA

- One acute construct failure w/o neurologic injury in a snow boarder who returned to sport 2 weeks postop
- 96% of respondents had not had any catastrophic construct failures

- 19% responded a negative

**TABLE 4. Sports/Activities Associated With Complications Following Spinal Fusion for Adolescent Idiopathic Scoliosis**

Sport/Activity	Number*
Cheerleading	3
Wrestling	2
Baseball/softball	2
Basketball	2
Diving	2
Weightlifting	2
Volleyball	2
Football	1
Hockey	1
Soccer	1
Tennis	1
Other	8

\*Some responses listed multiple sports/activities.

- 20 surgeons reported 27 cases with complications from returning to sport.

- 8 broken rods
- 6 endcap failures
- 6 screw pull out
- 5 other complications
- 13 required a revision procedure (54%)

- 1 proximal hook failure

# Does the LIV influence return?

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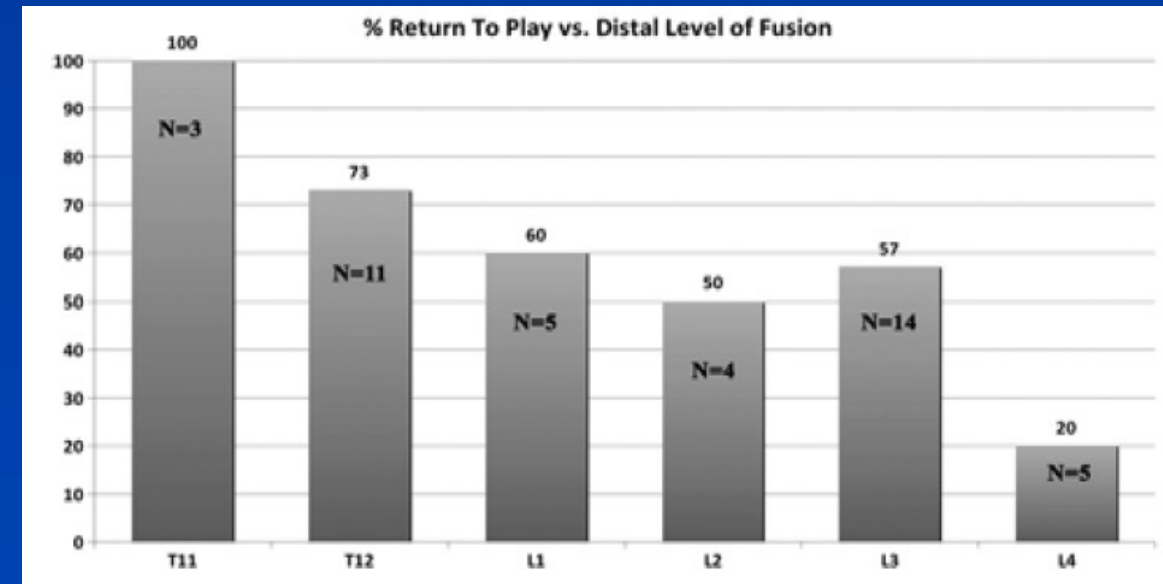
### What LIV would preclude return to collision sports?

Demographic Group	Doesn't matter (%)	L3 (%)	L4 (%)	L5 (%)
Overall	35	13	43	9
Field of training				
Spine OS	20	10	50	20
Ped OS	46	15	39	0
Annual case average				
≤20	14	0	71	14
>20	44	19	31	6
Years of practice				
0-10	33	17	50	0
11-20	43	14	43	0
>20	30	10	40	20

Surgeons are less likely to allow patients with more distal LIV to return to sport

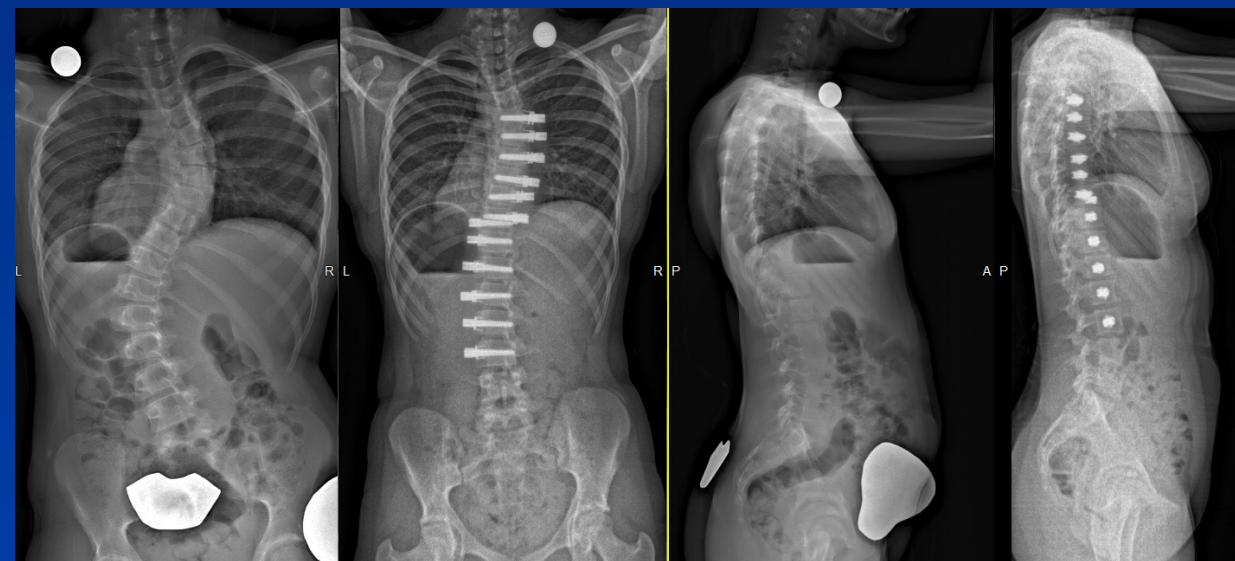
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Patients with more distal LIV are also less likely to return to sport

# Does the type of construct influence return?

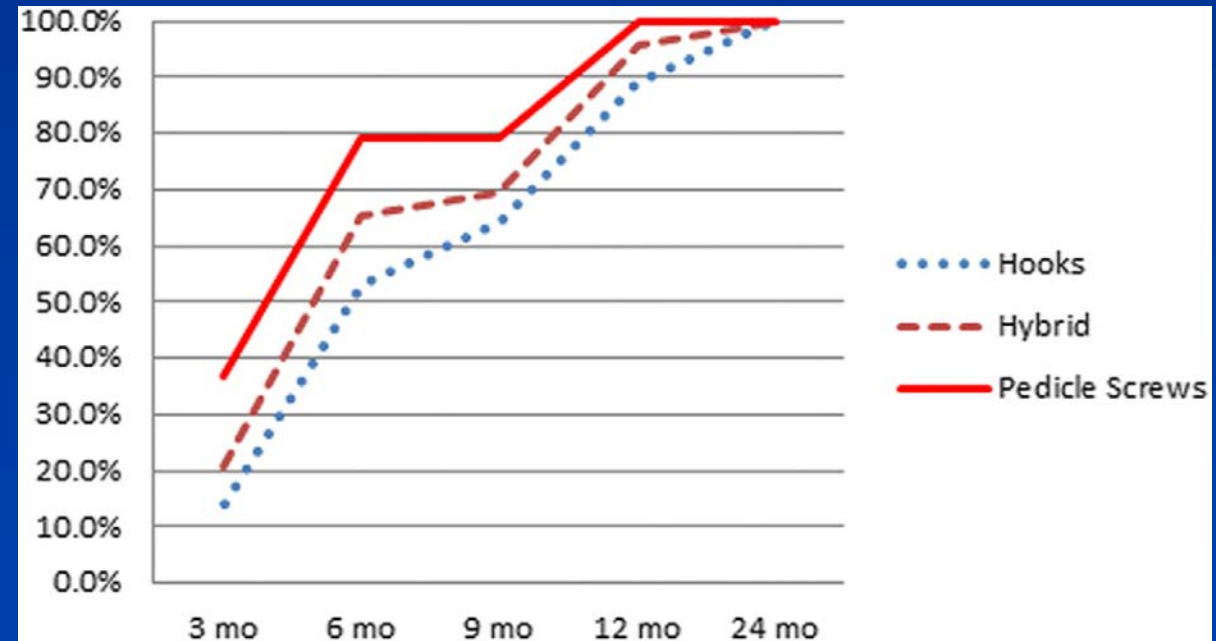


# Impact of construct type: Hooks vs Screws

- 100% of respondents allow return to sport:
- At 3 months
  - Running
    - 46% pedicle screw constructs
    - 24% hybrid
    - 20% hook constructs
  - Noncontact sports:
    - 37% pedicle screw constructs
    - 21% hybrid
    - 14% hook constructs
- Collision sports:
  - 12 months for the pedicle screw constructs
  - 24 months for both hybrid/hook constructs

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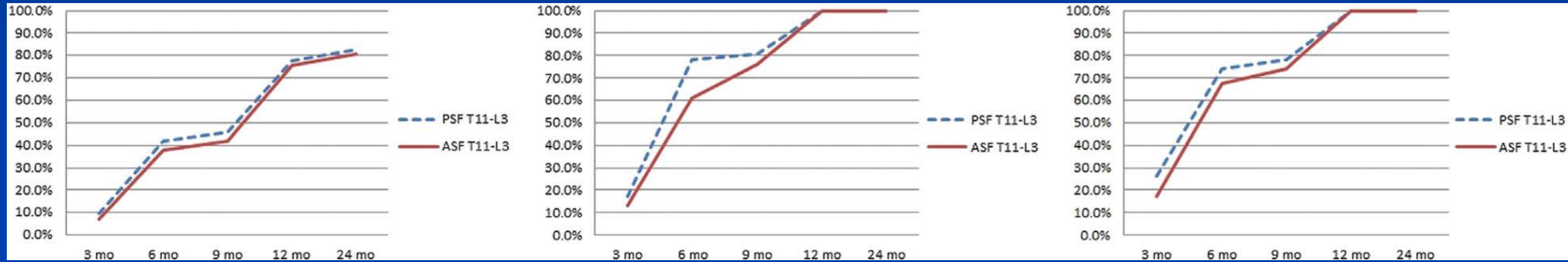


Sport	Time to return (mo)
Running	3
Noncontact	6
Contact	6
Collision	12

# Impact of construct type: Anterior vs Posterior fusion

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*Collision*

*Contact*

*Noncontact*



# Impact of construct type: VBT vs Posterior fusion

## Return to sport and daily life activities after vertebral body tethering for AIS: analysis of the sport activity questionnaire

Alice Baroncini<sup>1,2</sup> · Per David Trobisch<sup>2</sup> · Angelika Berrer<sup>2</sup> · Philipp Kobbe<sup>1</sup> · Markus Tingart<sup>1</sup> · Jörg Eschweiler<sup>1</sup> · Stephanie Da Paz<sup>2</sup> · Filippo Migliorini<sup>1</sup>

### School and physical activity after VBT

	School	PE/Gym	Backpack	Run	Bend	Bike
Patients (N)	30	31	30	28	30	27
< 1 month	17 (57%)	2 (6%)	16 (54%)	8 (29%)	21 (70%)	7 (26%)
1–3 months	12 (40%)	17 (55%)	13 (43%)	11 (39%)	9 (30%)	15 (56%)
4–6 months	1 (3%)	9 (29%)	1 (3%)	8 (29%)	–	4 (15%)
7–12 months	–	1 (3%)	–	1 (3%)	–	1 (3%)
> 12 months	–	2 (7%)	–	–	–	–

### Athletic activity after VBT

		Noncontact	Contact	Collision	
<i>Athletic activity prior to VBT</i>	Tot	27	18	15	Improvement
Noncontact (N= 23)	< 1 month	2 (7%)	3 (17%)	–	N= 27
Contact (N= 16)	1–3 months	15 (56%)	8 (44%)	8 (53%)	Yes= 7 (26%)
Collision (N= 14)	4–6 months	9 (33%)	7 (39%)	5 (33%)	Somewhat= 8 (30%)
	7–12 months	1 (4%)	–	2 (14%)	No= 12 (44%)
	> 12 months	–	–	–	

## When Do Patients Return to Physical Activities and Athletics After Scoliosis Surgery?

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Bend over, N= 90	2 (2.1)	52 (57.8)	24 (26.7)	10 (11.1)	2 (2.1)
Running, N= 87	0 (0)	37 (42.5)	33 (37.9)	16 (18.4)	1 (1.2)

Participation	Noncontact, N (%)	Contact, N (%)	Collision Sports, N (%)
Yes	50 (52.6)	33 (34.7)	8 (8.4)
No	44 (46.3)	61 (64.2)	86 (90.5)
N/A	1 (1.1)	1 (1.1)	1 (1.1)
Return Time	Noncontact	Contact	Collision Sports
1–3 months	13 (26)	8 (24.2)	0 (0)
4–6 months	14 (28)	13 (39.4)	3 (37.5)
7 months–1 year	18 (36)	11 (33.3)	4 (50)
Over 1 year	4 (8)	1 (3.0)	0 (0)
Did not return	1 (2)	0 (0)	1 (12.5)

Return to school, physical activity and sport was faster after VBT but VBT patients were more active preop

# Summary

- Not all patients return to sport
  - Preserving motion segments
  - Pedicle screw or hybrid constructs may facilitate earlier return
- Most patients allowed to return to:
  - 3 months: Noncontact nontwisting sports
  - 6 months: Noncontact twisting and contact sports
  - 12 months collision sports



# You can do it!

A Silver Medal Winner at the 13th World Wu Shu (武术) Championship 2015 17 Months After Selective Thoracic Fusion for Adolescent Idiopathic Scoliosis

*A Case Report*

Chris Yin Wei Chan, MS Orth, Izzuddin Aziz, MMedSc, Fong Wei Chai, MBA, and Mun Keong Kwan, MS Orth

**US Olympic sport climber Kyra Condie not slowed after 10 fused vertebrae in her spine**



**Tom Schad**  
USA TODAY



(with the right timing, training and follow-up)

# Any questions?

## Return to Activities After Spinal Deformity Surgery (srs.org)

For any questions:



**Our Location**

3101 SW Sam  
Jackson Park Road  
Portland, OR 97034



**Our Phone**

503-221-3424



**Email / Website**

[mwelborn@shrinenet.org](mailto:mwelborn@shrinenet.org)  
[shrinerschildrens.org](http://shrinerschildrens.org)



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