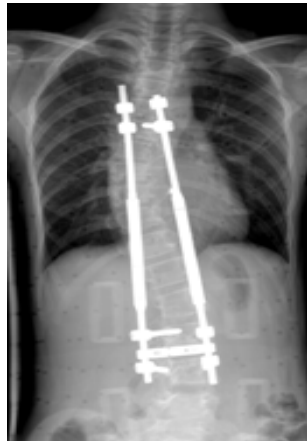


MASTER'S TIPS & TRICKS USING MAGEC™



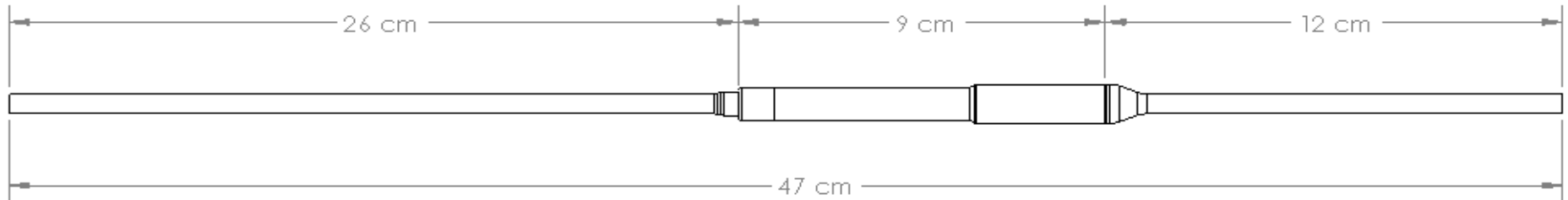
Colin Nnadi FRCS(ORTH)
Oxford University Hospitals
Oxford UK

Introduction

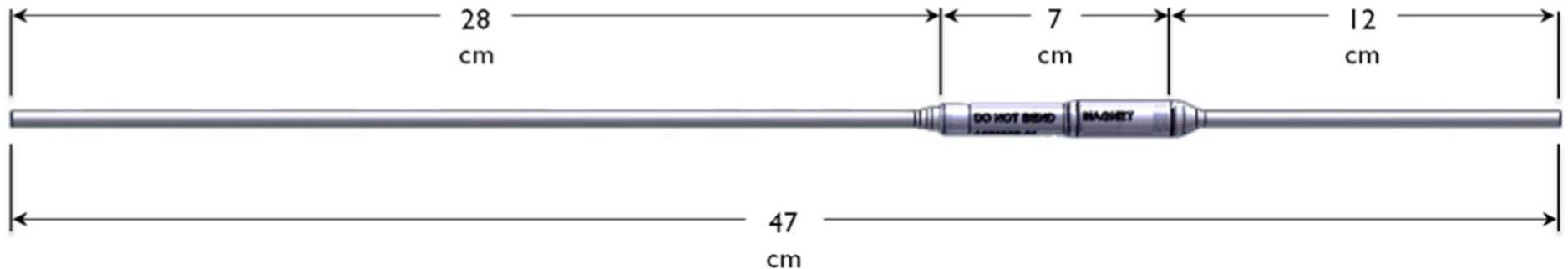
- Distraction technique principles
- Case scenarios
- Conclusion

MAGEC™ IMPLANTS

90mm Actuator Rod – 48mm distraction capability



70mm Actuator Rod – 28mm distraction capability



Dual Rod Construct

SLR – OFFSET
ROD

AD

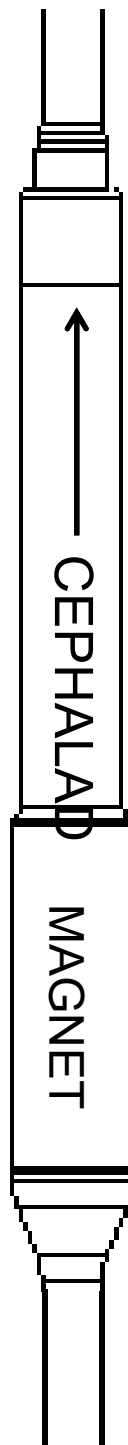


AD

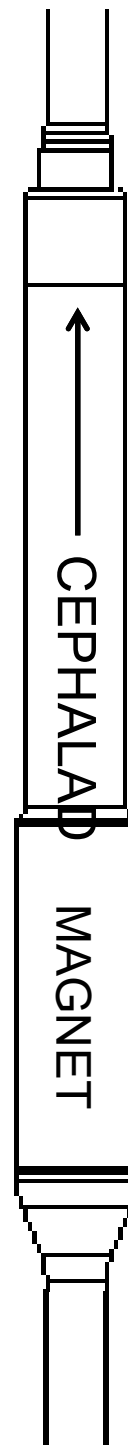


SL – STANDARD
ROD

Dual Rod Construct

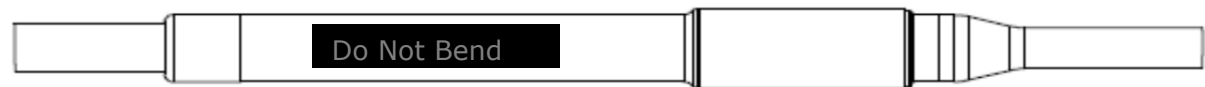


2 x SL – STANDARD
ROD



Surgical Technique

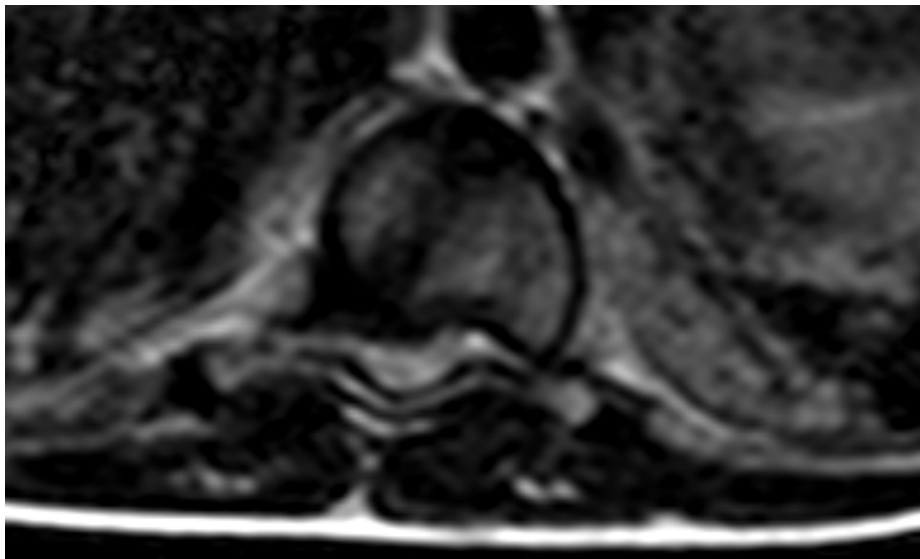
- 2 incision approach
- Prepare the sub-muscular bed
- Insertion of anchors
 - Proximal – Screws and/or hooks
 - Distal – Screws
- Rod cutting and contouring – cannot bend the actuator portion of the rod

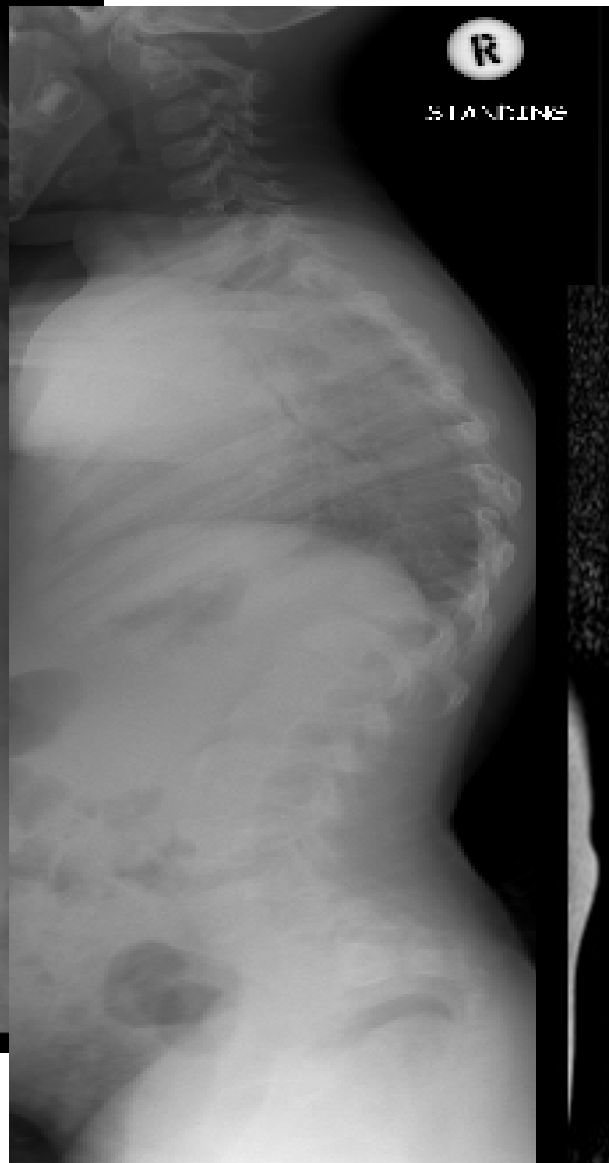
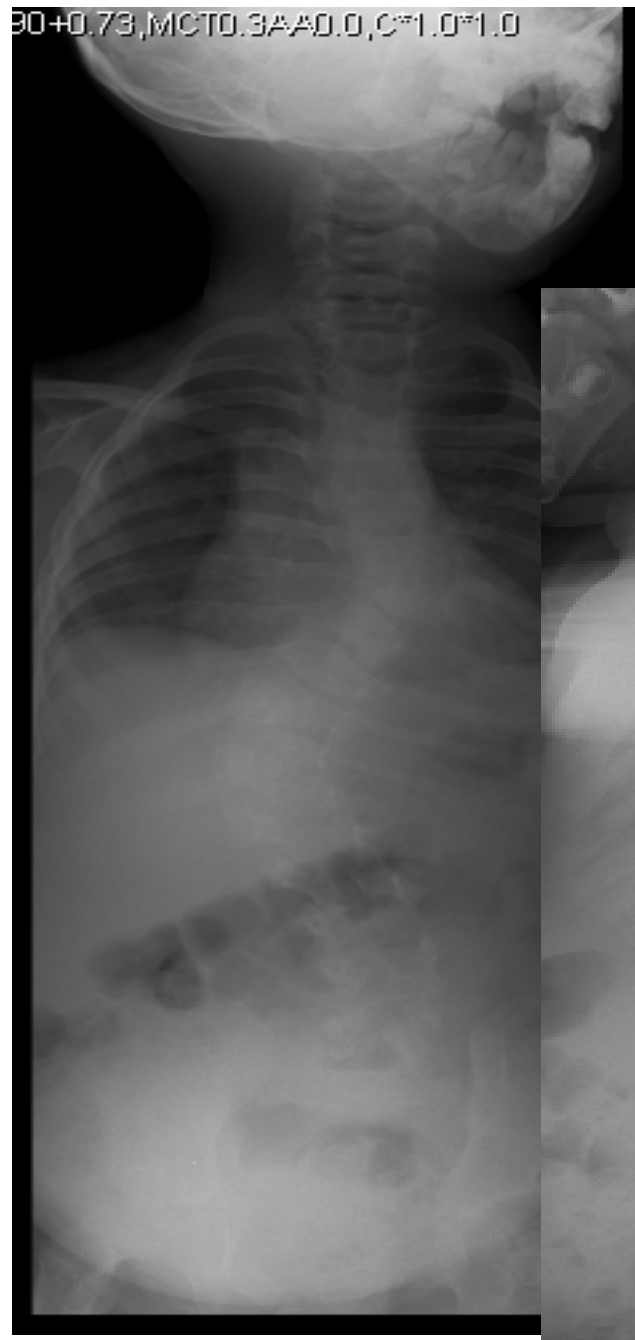


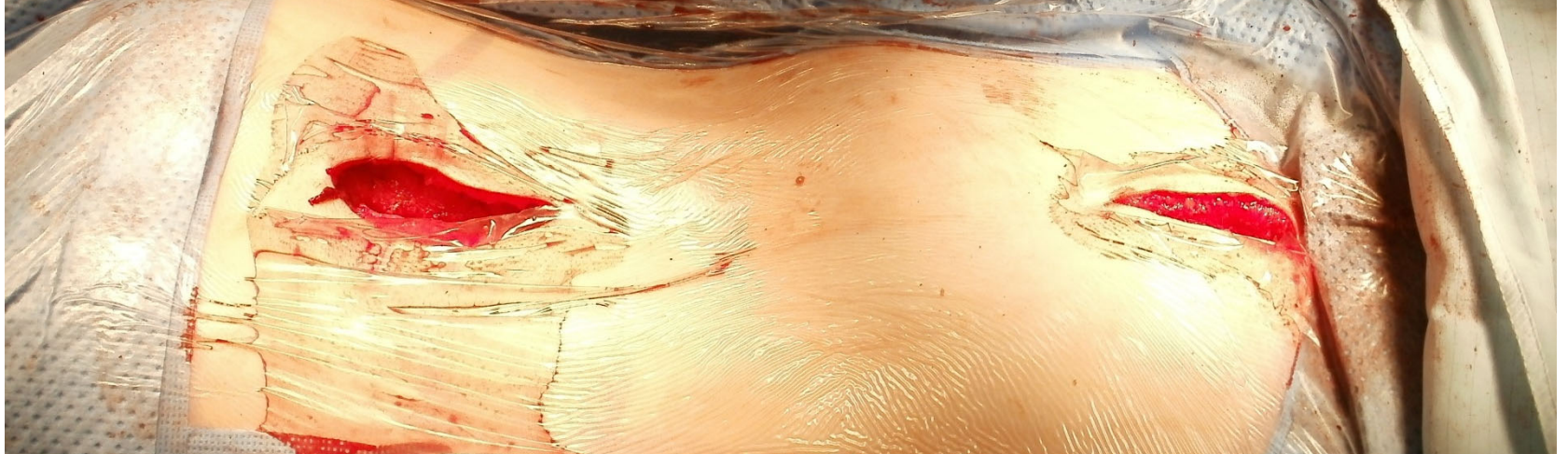
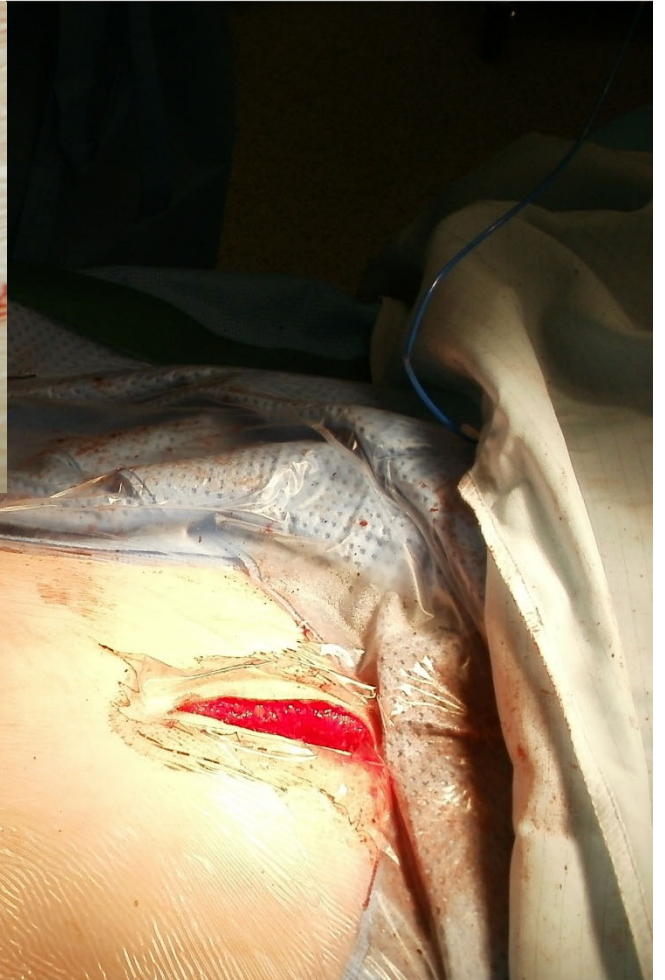
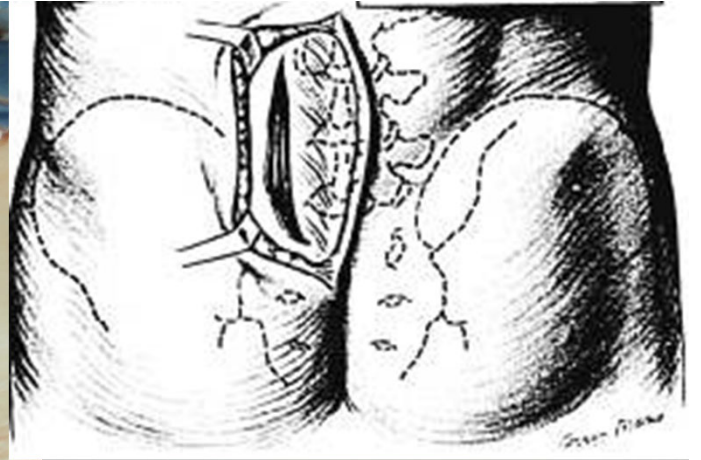
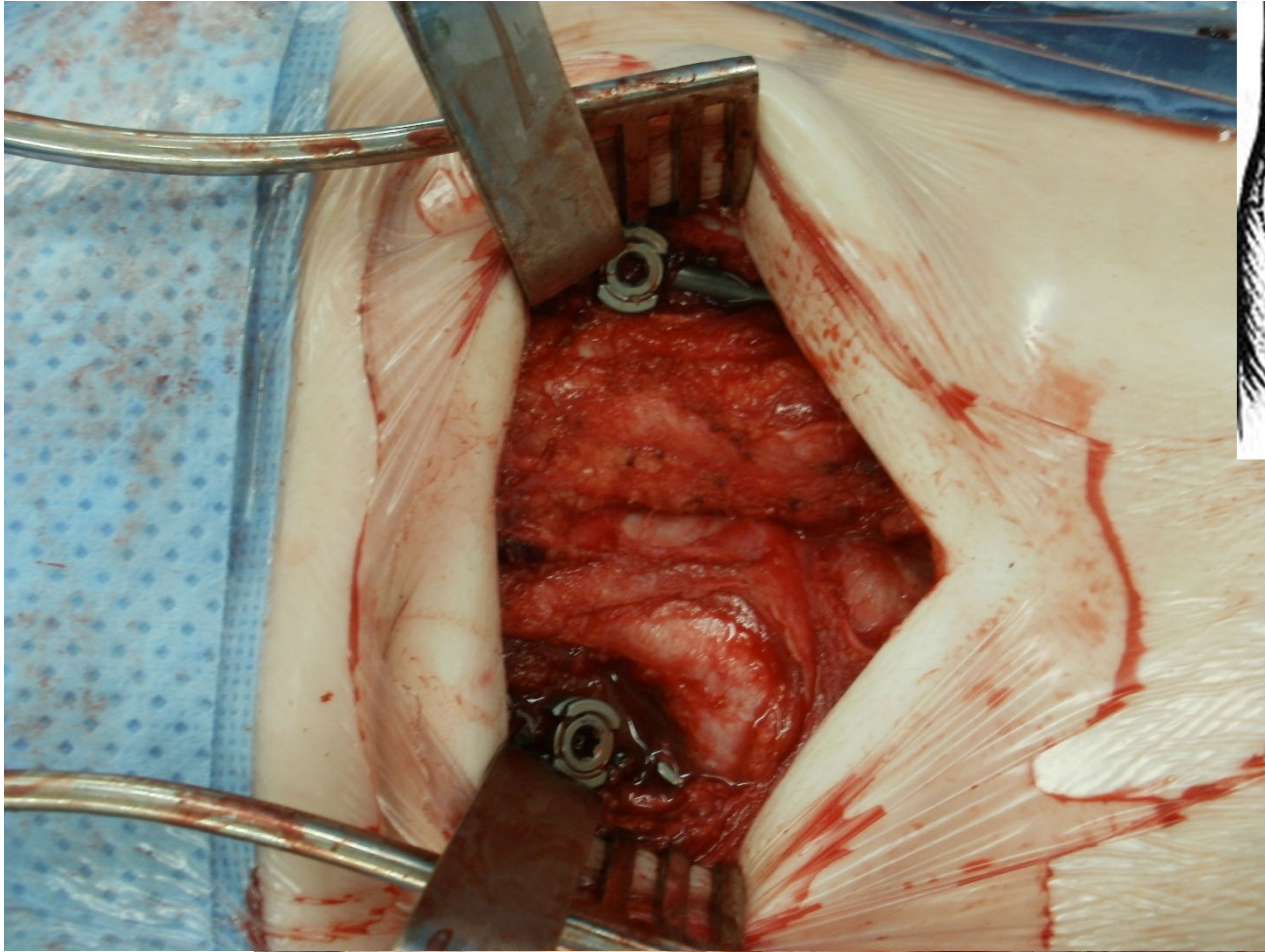
- After contouring and cutting the MAGEC™ rod – carry out a manual test distraction before implantation

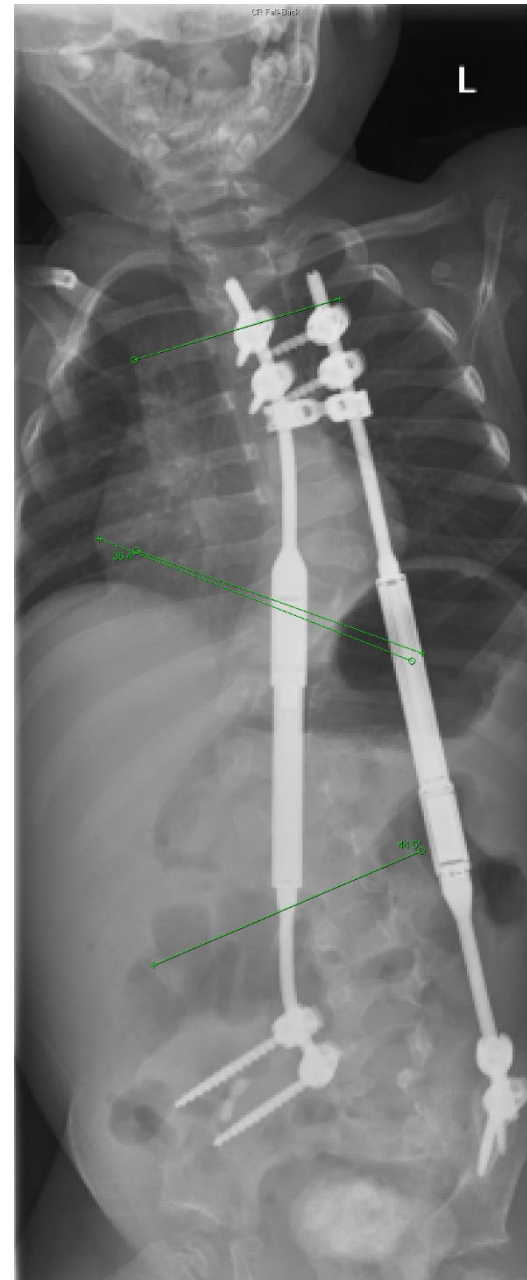
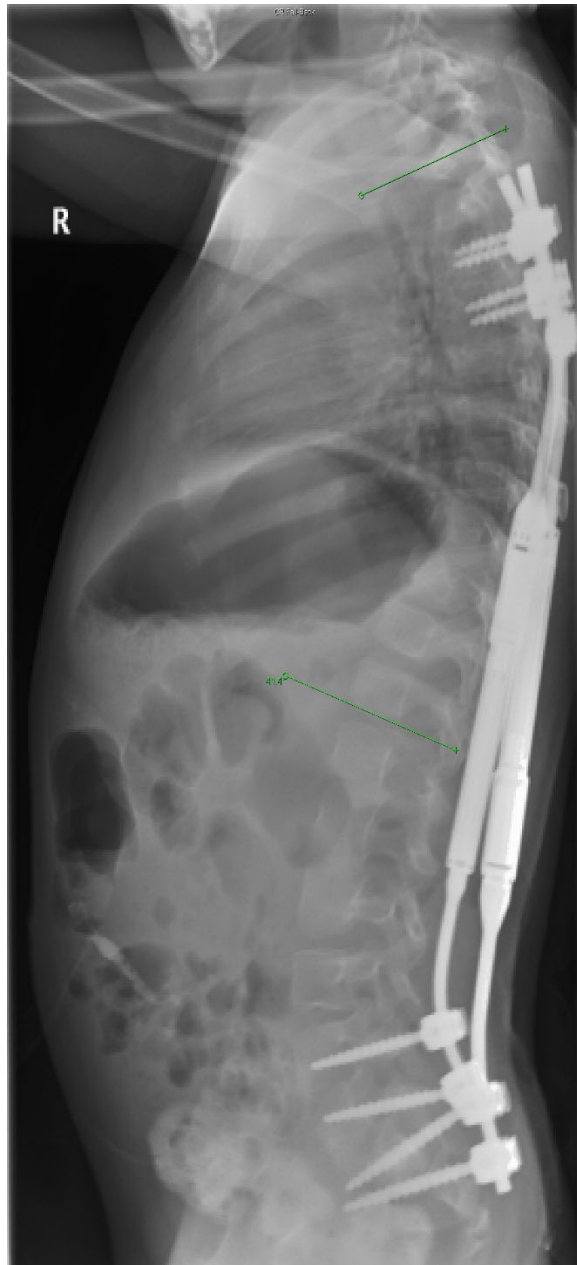
Case 1 – Sticklers Syndrome

- 3 ½ yr old F
- 8 month progressive spinal deformity
- 3/52 hx of progressive loss of mobility
- kyphosis at T7 with cord compression (MRI)
- Abnormal lumbo-sacral transition



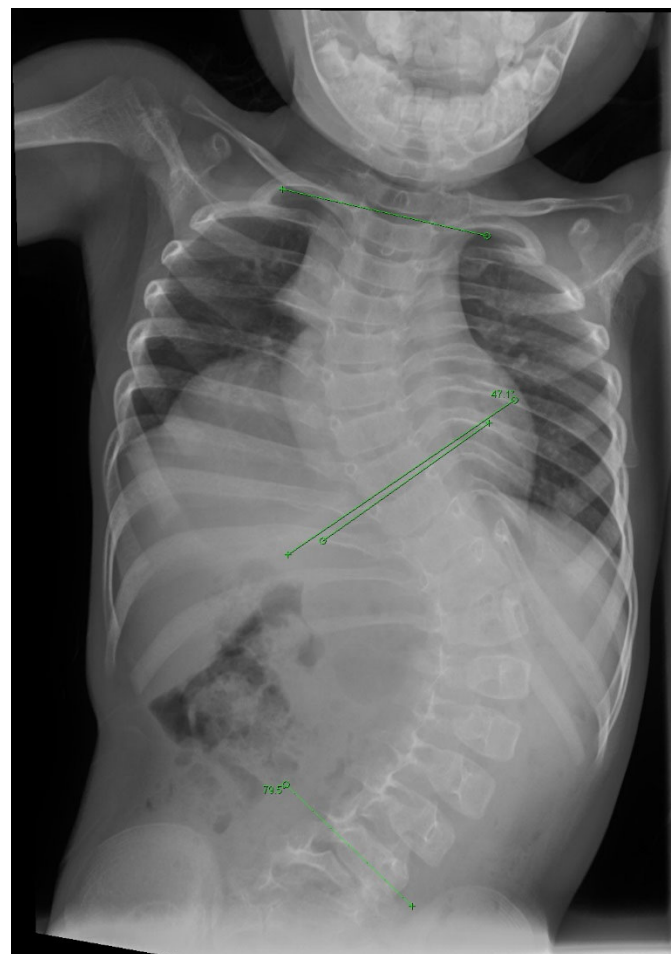


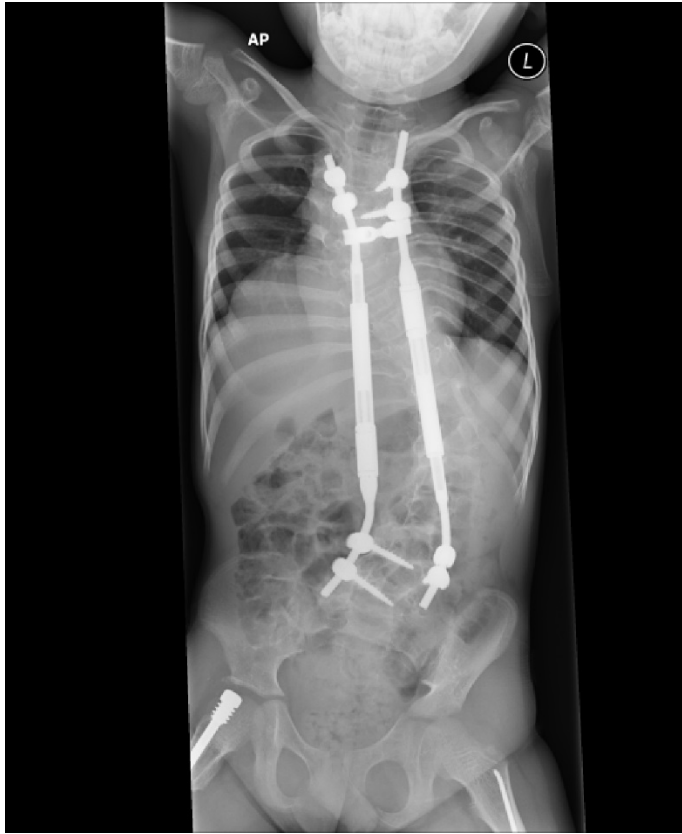




Case 2 - OI

- 2 ½ yr old M
- OI type III
- Life long Pamidronate
- Progressive curve
- Noticeable deteriorating exercise tolerance
- Failed serial casting
- T11 –L5 76°
- T2-T10 46°





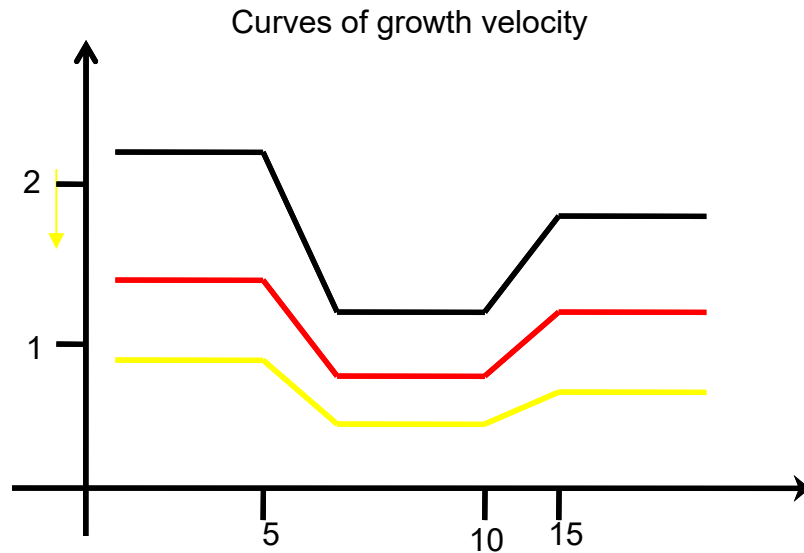
MAGEC™ ERC



Patient Positioning



‘TAIL-GATING’ PRINCIPLE USING ANNUAL GROWTH VELOCITY AS A GUIDE



- ‘Tail-gating’ concept to shadow growth
- Spine in EOS does have growth potential
- Magec rods allow for controlled distraction
- Apply knowledge of expected growth
- Less force on construct = less risk of failure
- ‘Scientific approach’

Birth – 5 yrs 2.2cm 20kg

5 – 10 yrs 1.1cm 30kg

10 yrs – Puberty 1.8cm >30kg

(DIMEGLIO)

THE FLUOROSCOPIC TECHNIQUE FOR MONITORING DISTRACTION OF A NON-INVASIVE LENGTHENING DEVICE(MAGEC™) IN EARLY ONSET SCOLIOSIS

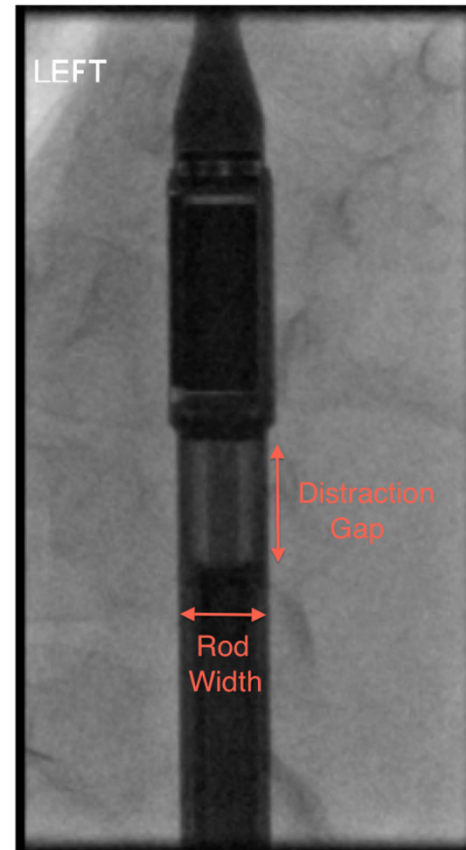
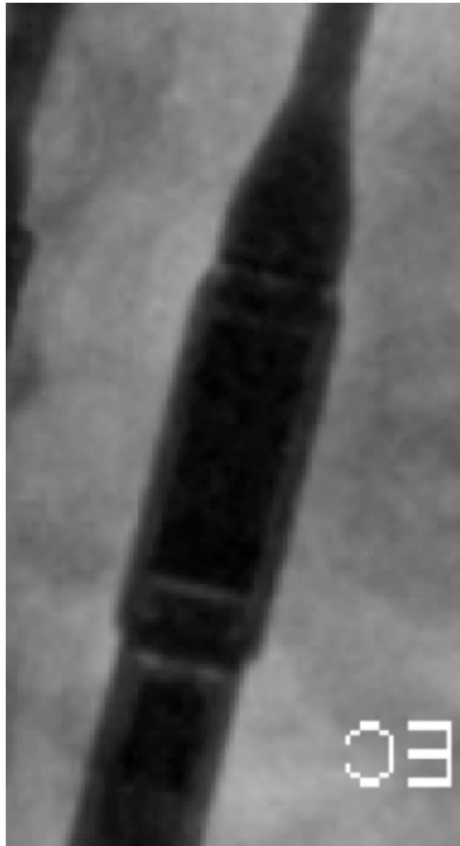


Figure 1a (left): Fluoroscopic view of the actuator prior to distraction.
Figure 1b (right): Actuator post distraction. The true distraction gap can be measured and calculated by using the width of the rod (9mm) to allow for magnification. True gap= width of rod measured on fluoroscopy/9 x distraction gap measured on fluoroscopy.

Table 4. Changes in height and weight per year

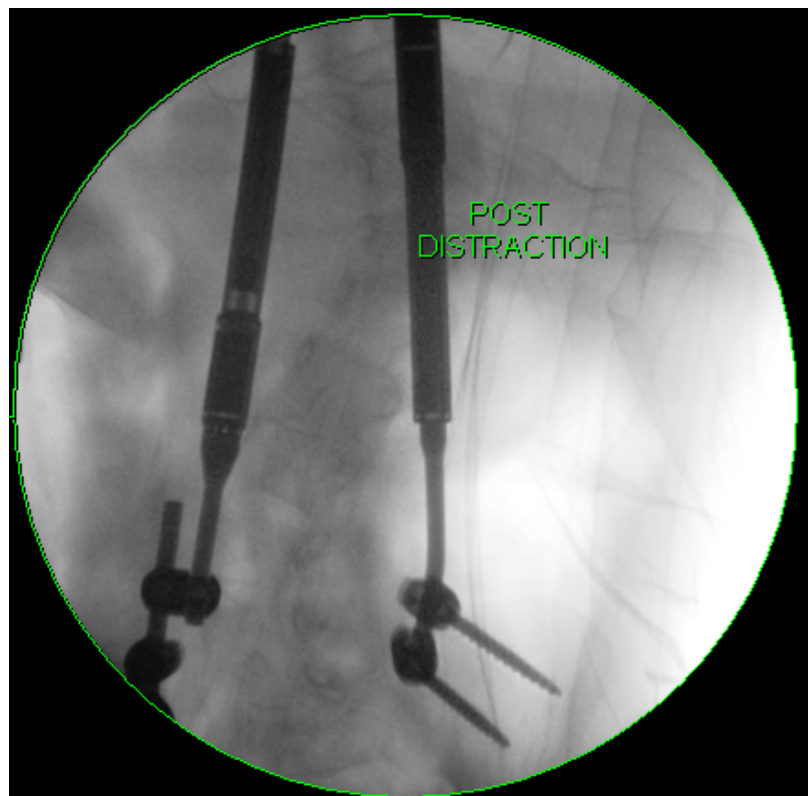
Patient no	Gain in standing height per year (cm / year)	Gain in sitting height per year (cm / year)	Gain in weight per year (kg / year)
1	4.9	1.9	1.7
2	7.8	4.3	2.1
3	6.9	4.3	3.4
4	5.0	1.6	0.8
5	4.5	1.0	7.2
6	7.9	3.3	4.5
7	8.1	4.2	2.6
8	5.2	2.0	1.0
9	7.0	2.2	2.7
10	5.9	1.9	3.4
11	6.9	2.4	1.7
12	8.8	2.3	2.1
13	9.2	2.4	3.3
14	7.4	3.2	1.1
15	8.1	5.5	2.3
16	5.1	0	3.1
Mean	6.8	2.7	2.7

Table 3: Cobb angles before surgery, following surgery and at most recent follow up
(*p=0.01 before surgery vs after surgery, before surgery vs most recent follow up)

Patient number	Before Surgery (degrees)	After Surgery (degrees)	At most recent follow up (degrees)
1	62	35	32
2	40	25	21
3	72	68	63
4	60	42	46
5	82	61	62
6	85	41	48
7	42	38	29
8	56	40	47
9	61	68	69
10	43	39	44
11	72	60	61
12	52	41	38
13	45	48	44
14	64	53	60
15	84	52	31
16	40	29	30
Mean	60	46*	45*

Conclusion

- Encouraging results so far with 'Tail-Gating'
- Tail-Gating controls Cobb angle and maintains growth & weight parameters
- Versatile system that can be used in variety of clinical scenarios
- Useful for correction of flexible sagittal plane deformities as well



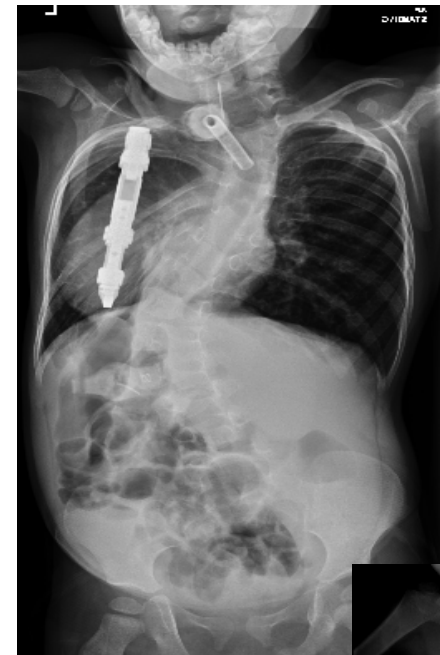


Case 3 – VACTERL Syndrome

- 5 yr old M
- IVF
- VACTERL with failure to thrive
- Initial review @ 15 months
- Multiple vertebral anomalies
- No cord abnormalities
- VEPTR with multiple revisions
- Truncal imbalance
- Respiratory arrest during GA



May 2009
Age 1 yr 3mths

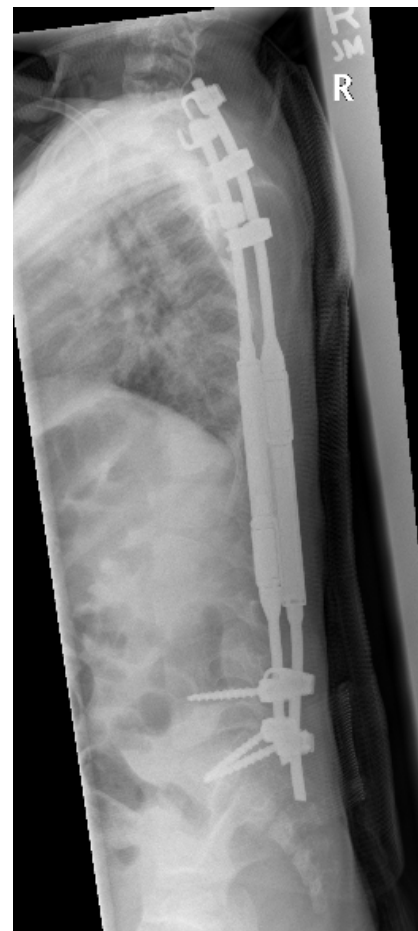
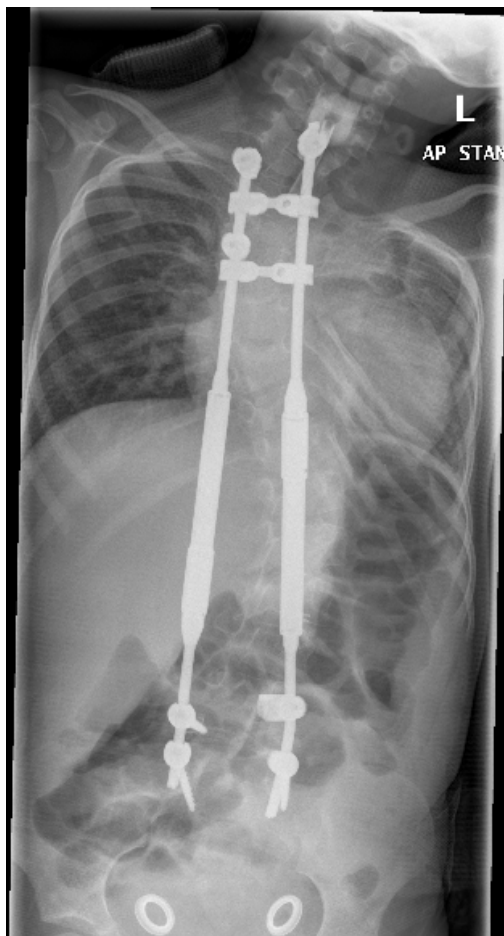


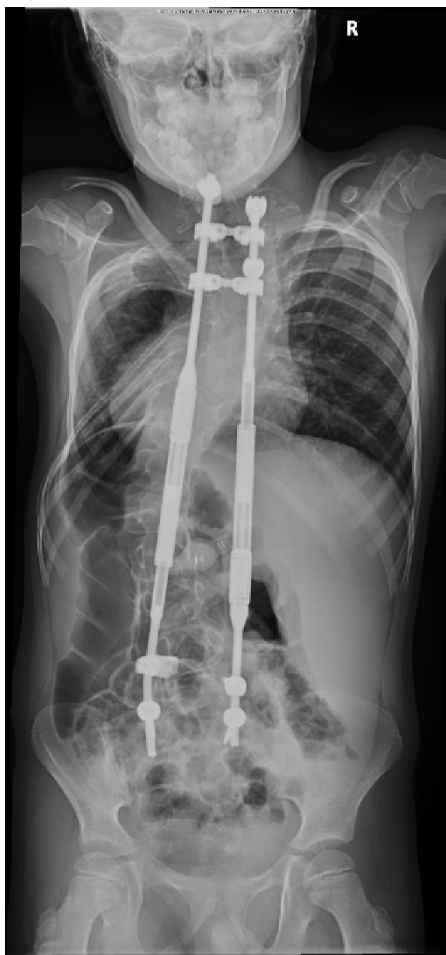
June 2010
Age 2yr 4mths



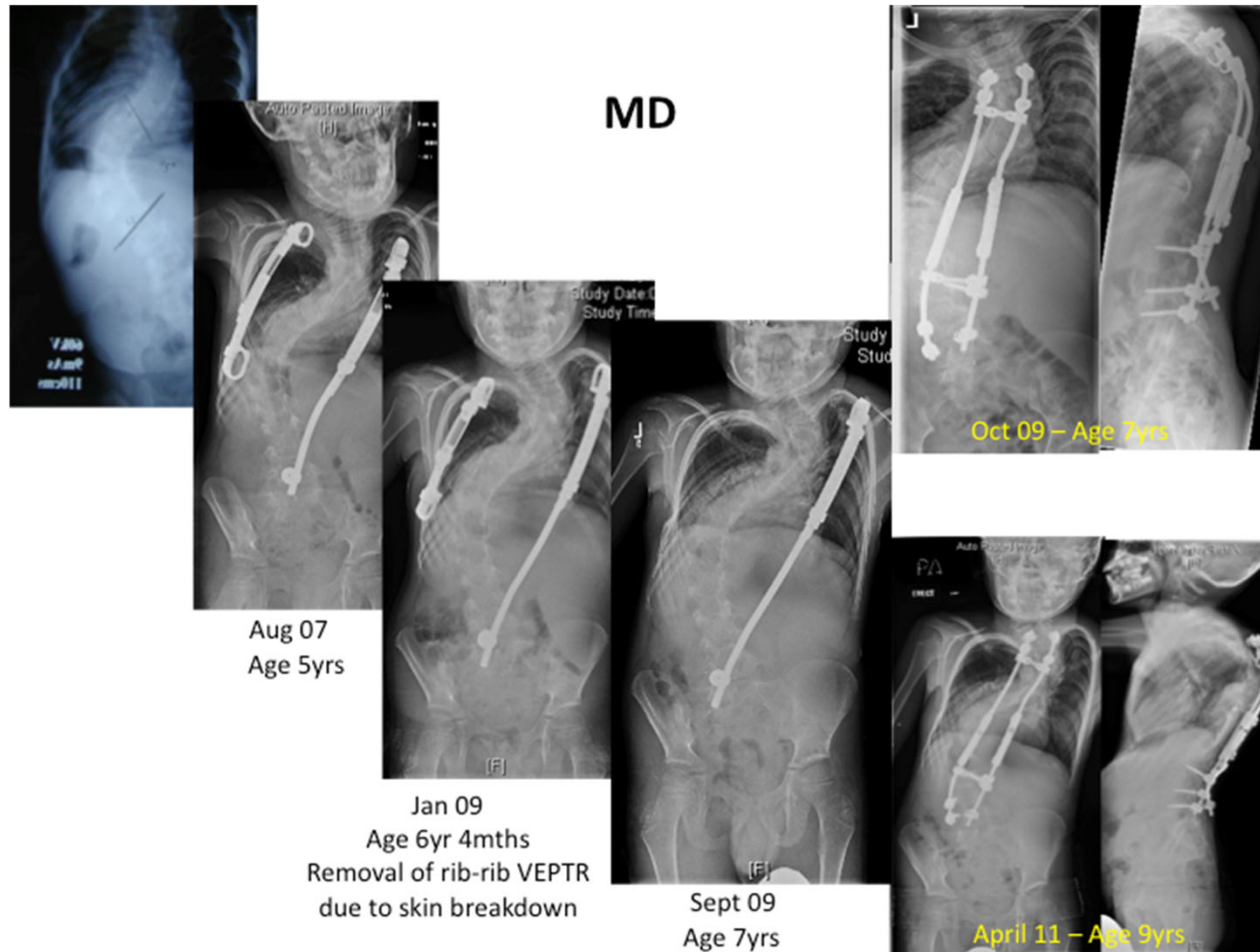
July 2011
Age 3yr 5mths

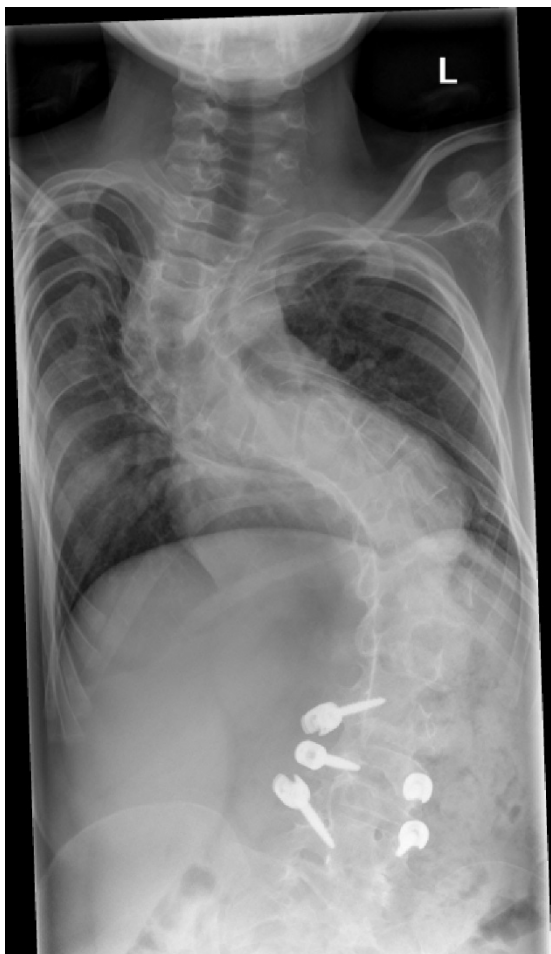
Conversion to Magec





MD 10 yrs IIS



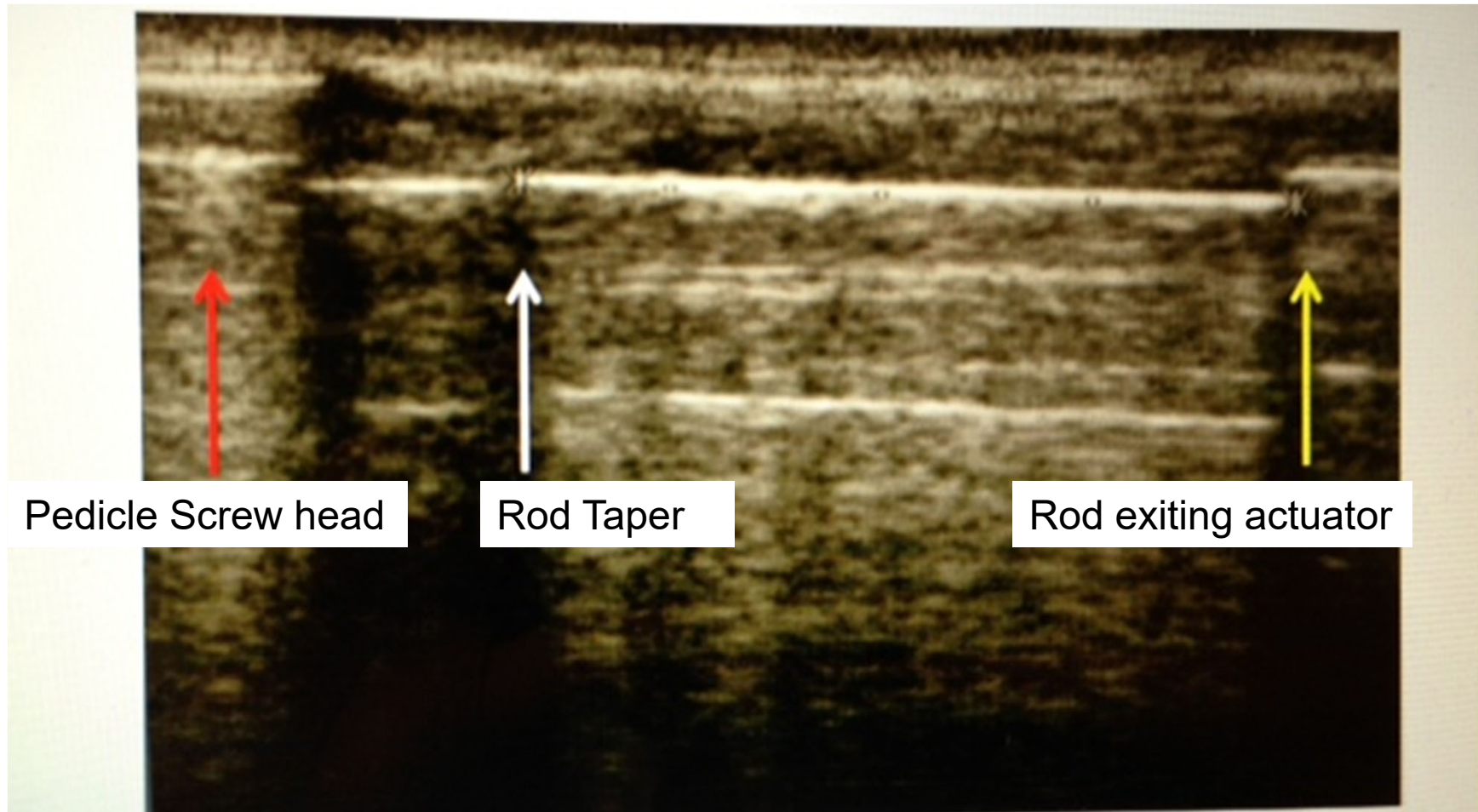








Ultra Sound Distraction Measurement Landmarks



EXPANSION GAP

Table 2 Differences between ID and TD in each rod. (ID – Intended distraction, TD – true distraction)

Patient no / details	Number of Distractions	ID-TD Right Rod (mm)	ID-TD Left rod (mm)
1	5	4.19	2.58
2	7	17.96	20.77
3	7	4.47	4.27
4	5	11.13	N/A
5	7	23.55	26.23
6	7	10.41	11.87
7	8	13.11	16.48
8	5	5.27	7.12
9	6	15.59	16.14
10	7	19.19	20.70
11	8	5.29	4.42
12	7	12.57	15.27
13	7	6.67	6.83
14	4	9.01	9.48
15	4	4.33	-0.66
16	3	4.22	6.03

NICE COST EVALUATION

Table 6 Base-case results (cost savings are shown as negative values)

	Cumulative discounted cost of MAGEC system	Cumulative discounted cost of CGR	Incremental cost per patient
1 year after implantation	£29,418	£21,644	£7,774
2 years after implantation	£31,311	£27,795	£3,516
3 years after implantation	£33,137	£33,730	–£593
4 years after implantation	£34,900	£39,458	–£4,558
5 years after implantation	£36,601	£44,986	–£8,385
6 years after implantation	£38,242	£50,319	–£12,077
CGR, conventional growth rod			

4 year forecast (Oxford Study)

CGRS	Actual	Forecast Cost				Totals
Activity Volumes	31/03/13	31/03/14	31/03/15	31/03/16	31/03/17	
1) Preop Aassessment Clinic	245	166	170	173	177	931
2) Insertion of Initial system	14,124	0	0	0	0	14,124
3) Lengthening	1,966	4,011	4,091	4,173	4,256	18,496
4) Revision	1,925	0	0	0	0	1,925
5) Post Operative Care	2,772	2,828	2,884	2,942	3,001	14,427
6) Post Complication Operative Care	917	0	0	0	0	917
7) Total Cost Outpatient First Clinic Appointment	168	0	0	0	0	168
8) Total Cost Outpatient Follow Up Appointment	343	233	238	243	248	1,305
Total CGRS	22,460	7,238	7,383	7,531	7,681	52,293
NET	Actual	Forecast Cost				Totals
Activity Volumes	31/03/13	31/03/14	31/03/15	31/03/16	31/03/17	
1) Preop Aassessment Clinic	163	0	0	0	0	163
2) Insertion of Initial system	27,037	0	0	0	0	27,037
3) Lengthening in clinic	577	2,356	2,403	2,451	2,500	10,289
4) Revision	2,020	0	0	0	0	2,020
5) Post Operative Care	2,958	0	0	0	0	2,958
6) Post Complication Operative Care	541	0	0	0	0	541
7) Total Cost Outpatient First Clinic Appointment	168	0	0	0	0	168
8) Total Cost Outpatient Follow Up Appointment	229	0	0	0	0	229
Total NET	33,694	2,356	2,403	2,451	2,500	43,405
Total Difference	-11,234	4,882	4,980	5,079	5,181	8,888
Inflation Cost		2%	2%	2%	2%	
%	67					83.00398195
% Difference	-33					20
	7,488					

MAGEC™ SYSTEM

- Titanium Rod Implant



- External Remote Controller (ERC)

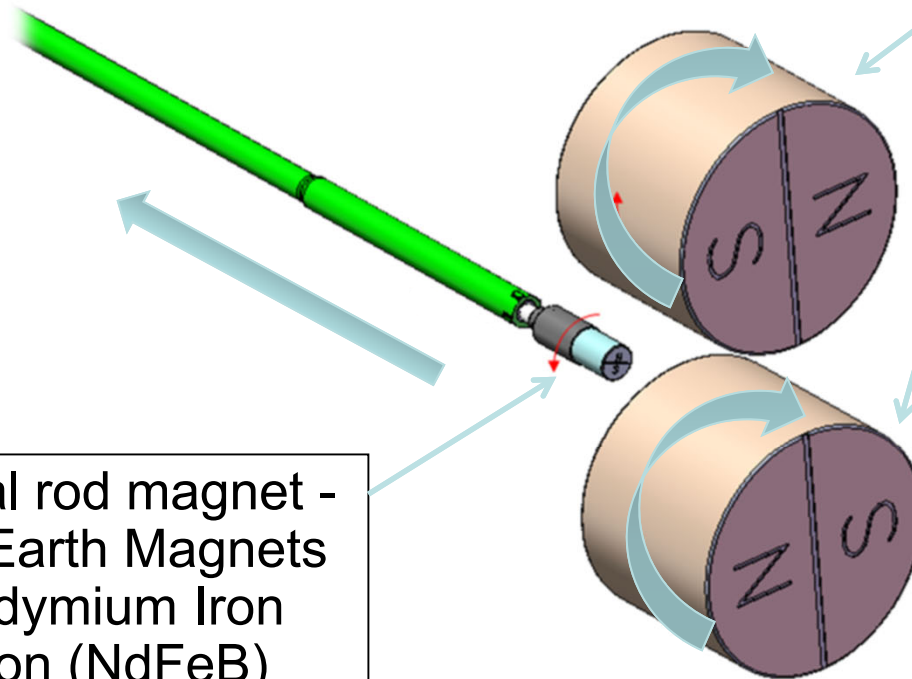


MAGEC™ ERC

Rotational force of the internal turning magnet creates an axial force on the lengthening rod

ERC - Rare Earth Magnets
Neodymium Iron Boron
(NdFeB)

Internal rod magnet -
Rare Earth Magnets
Neodymium Iron
Boron (NdFeB)



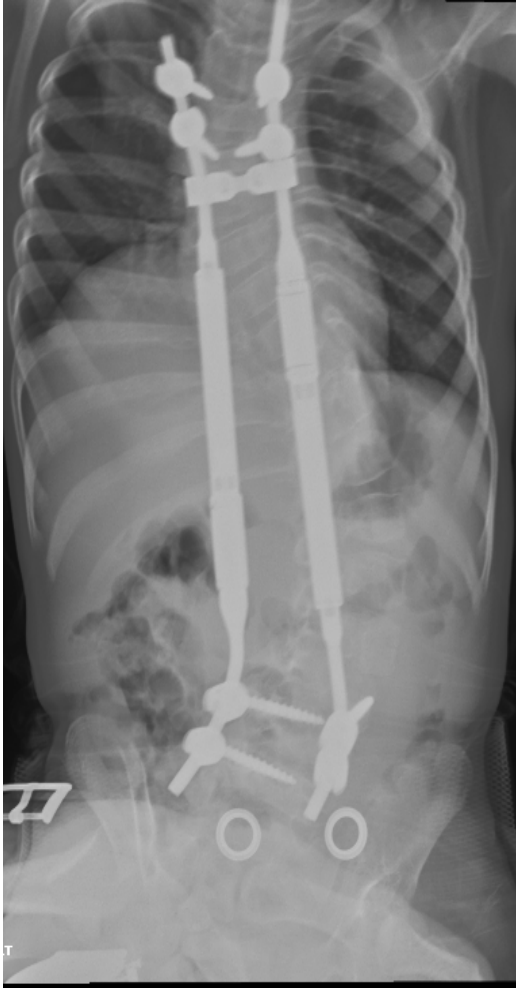
MAGEC™ IMPLANTS



- 4.5mm and 5.5mm Diameter
- Anchored with compatible sized screws and hooks

Distraction Techniques

- Outpatient clinic setting
- Maximum vs Controlled
- Vast debate surrounding frequency and technique of distraction
 - Kenneth Cheung, Hong Kong – 1/12
 - Hilali Nordeen, RNOH Stanmore – 6/12
 - Oxford 'Tail-gating' – Dimeglio's growth curve
- Fluoroscopy (Oxford) – 50x less radiation
- Ultrasound (Hong Kong)



Patient number	Age at time of surgery	Number of Distractions	Previous Spinal Instrumentation	Instrumented levels	Sex	Diagnosis
1	8	5	None	T3/4- L4/5	F	Chromosome 17 duplication
2	6	7	TGR	T3/4 – L2/3	M	Central Core disease
3	6	7	TGR	T4/5 – L3/4	M	Prader Willi Syndrome
4	7	5	VEPTR	T4/5 – L2/3	F	Congenital Scoliosis
5	11	7	TGR	T3/4 – L4/5	F	Idiopathic
6	9	7	None	T4/5-T12/L1	F	NF type 1
7	4	8	TGR	T4/5 – L3/4	M	Syndromic Scoliosis
8	7	5	None	T4/5-L4/5	M	Charge Syndrome
9	7	6	TGR	T3-5 – L4/5	M	Smith Lemli Opitz Syndrome
10	3	7	None	T4/5 – L3/4	M	Idiopathic
11	2	6	None	T3/4 – L4/5	M	Osteogenesis Imperfecta
12	6	7	TGR	T4/5-L3/S1	M	Central Core disease
13	3	7	VEPTR	T1/2 – L5/S1	M	VACTER Syndrome
14	3	4	None	T3/4 - pelvis	F	Sticklers Syndrome
15	4	4	None	T3/4-L3/4	F	Congenital Connective Tissue Disorder
16	4	3	None	T3/4-L3/4	F	Prader Willi Syndrome