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NHS Foundation Trust

Staying Ahead of the Curve

The Evolution and Future of Scoliosis Brace Treatment

Steve Hewitt
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- Introduction
- Changing Concepts
- Bracing Principles
- Shaping the future
- What the Future Holds

Introduction

- Graduated from Strathclyde Uni 2007
- Edinburgh - Auckland - Sheffield
- Always involved in scoliosis clinics

Boston Bracing

→ **SpineCor Brace**

→ **Gensingen Brace**

→ **CMP Brace (2021)**

Introduction

Winner at 2024 Advancing Healthcare Awards:
- BAPO Award for Inspirational Innovators in Prosthetics and Orthotics
- Overall Winner

HCPC Annual All Staff Meeting
- Representing Orthotics
- Presenting my winning project

Can you spot the error

- Introduction
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50 YEARS

Brace Evolution
1972 – 2022

Milwaukee

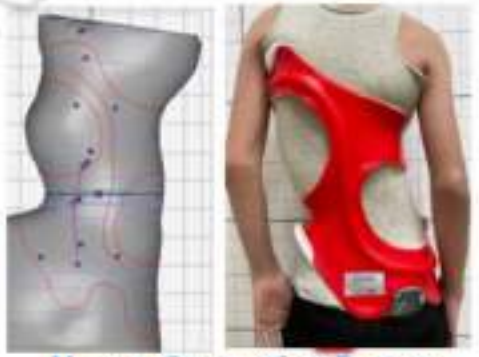
Boston

50 YEARS

Brace Evolution
1972 – 2022

Milwaukee

Boston



Hyper-Corrective Braces

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Effects of Bracing in Adolescents with Idiopathic Scoliosis

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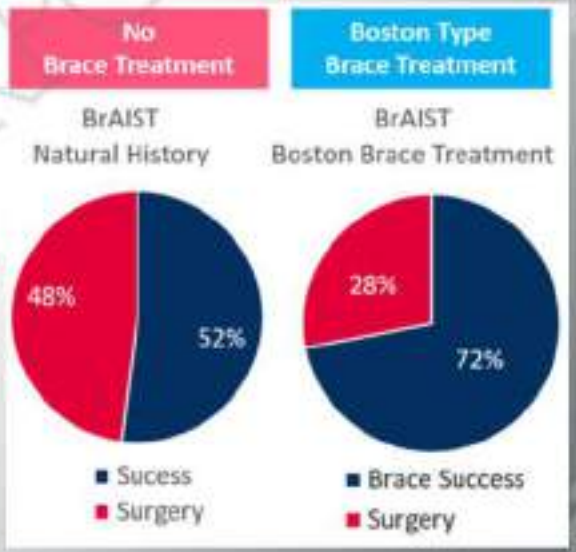


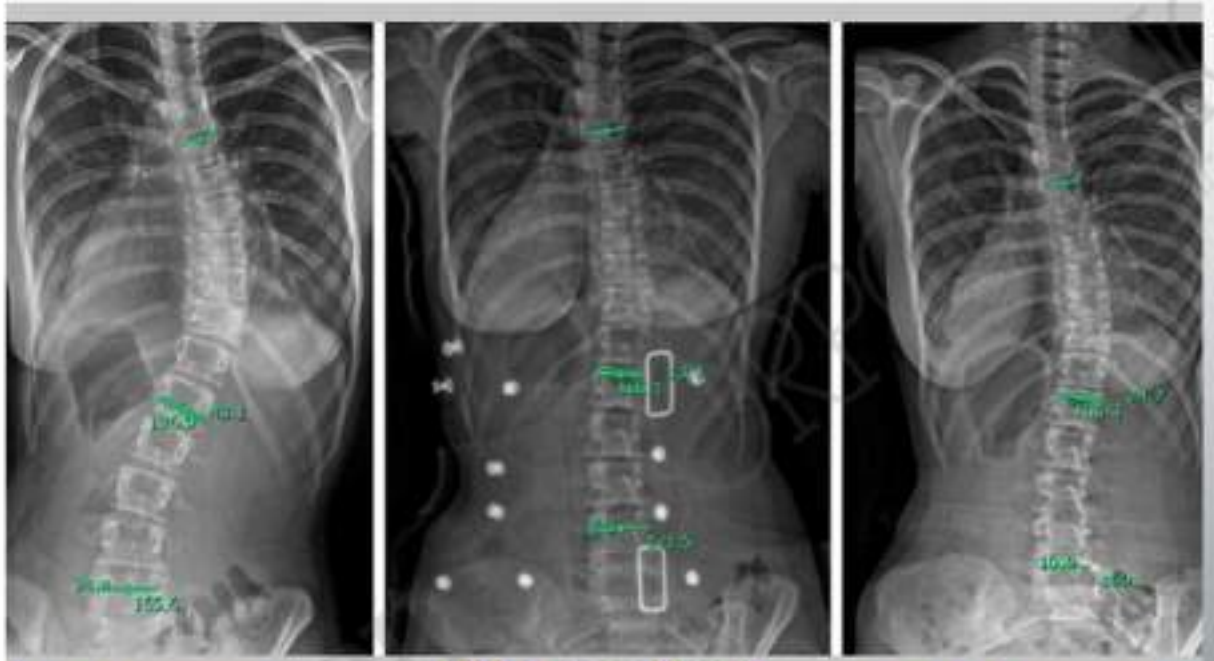
- Surgeons historically unwilling to accept bracing and the evidence around it, even though there is significant lack of evidence of surgical techniques and instrumentation used
- Very little long term follow up for the benefit to surgery
- Significant failings have been seen in surgery recently

Boston Bracing:

- Averaging 25 – 33% in brace correction
- Correction not expected to be seen out of brace
- At best bracing will avoid progression of curve
- Bracing still successful if progression occurs, but kept under 50 degree surgical threshold

Hypercorrective Postural Bracing

- Averaging 50 – 100%+ in brace correction
- Correction can be expected out of brace
- Now best scenario is significant reduction of curve size by end of growth



Pre-treatment
43° Cobb angle

1st in brace X-ray
(CMP brace)
14° Cobb angle

End of treatment
(27 months)
25° Cobb angle

The Evolution and Future of Scoliosis Brace Treatment

Pre Brace 55 degrees

1 month in brace
21 degrees
62% IBC
(In Brace Correction)

First out of brace
@ 5 months use
29 degrees
47% correction

2yrs 8m in brace
14 degrees
75% IBC

3yrs 9m use
18 degrees
67% correction

Out of brace!

Is there a Relationship Between In-Brace and Out of Brace Cobb Correction observed during Postural Over-Correction Hypercorrective (POCH) Brace Treatment of Idiopathic Scoliosis (IS) Patients?

Steve Newell
Scoliosis Clinical Specialist Orthotist

- IBC and OBC were found to be positively correlated r(61) = 0.47, p<0.001
- Weak positive correlation between IBC and OBC, but this weak positive correlation is highly statistically significant

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Optimising Full-time Brace Treatment of Idiopathic Scoliosis (IS) using In-Brace Correction (IBC) as a predictor of brace efficacy

Author	Year	Number of Patients	Average % IBC	Average Cobb
Hopf and Heine[1]	1985	52	41%	36°
Rigo et al.[10]	2002	105	31%	37°
Rigo[11]	2007	32	42%	33°
Weiss et al.[20]	2007	81	51%	36°
Maruyama et al.[21]	2012	34	36%	37°
Weiss and Werkmann[13]	2013	34	59%	31°
Bonagas et al.[12]	2013	92	56%	29°
Weiss et al.	2013	31	66%	31°
Mills & Hewitt (SCH Patients treated 2020-2022)	2022	55	47%	37°
(SCH Patients treated 2021-2022)		19	63%	30°

Young 2019, Service review, GOSH - <40° Curves Average Correction: 30%

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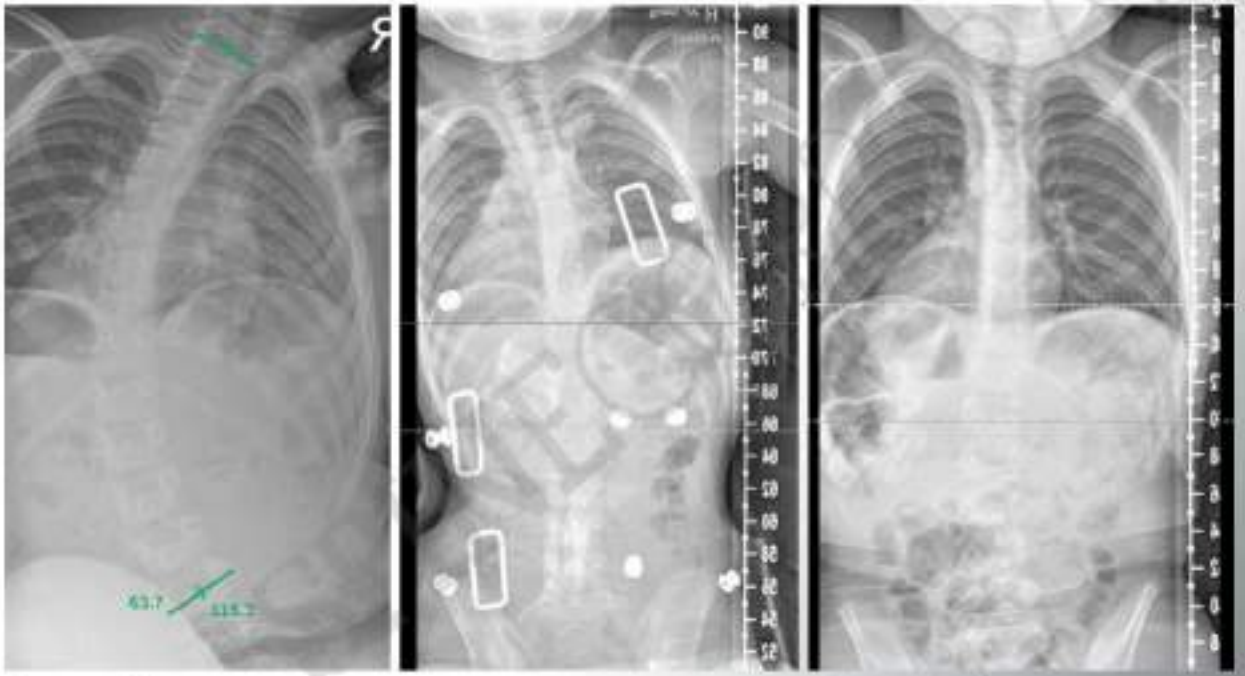
Can this be used in NM bracing too?



Start of brace treatment

4 years in brace treatment

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Standard Approach

1/ The Perfect Fit
- Capture deformity
- No correction
- Support posture
- Comfortable
- More harm than good?

Standard Approach

2/ Boston Style/Symmetrical TLSO

- Has been the go-to style for years
- Much more effective than 'Perfect fit braces'
- Some correction expected in brace
- 3-point pressure principles
- Solid Pelvis to fix pelvis and control thoracic forces
- Relies on compression
- Reduction in volume creates soft tissue compression and natural elongation
- May have a window to relief some rib pressure opposite main correction pressure (not the same function as postural brace)
- Relatively 2-Dimensional approach

Modern Approach

What is Postural Hypercorrective Bracing?

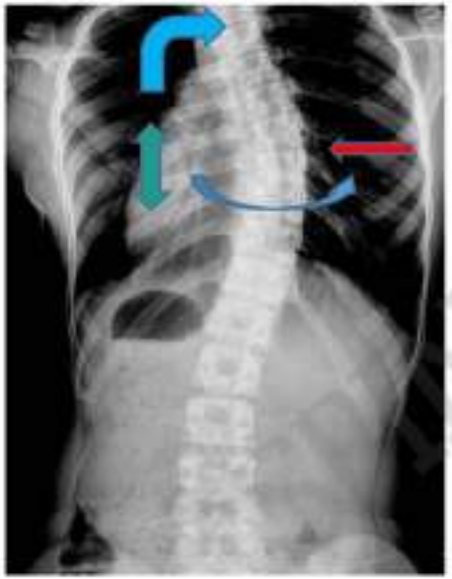
-Uses more natural postural movements (Cheneau principles) to achieve much more effective correction, while usually being found to be significantly more comfortable

-Asymmetrical design – do not need to come high on both side

-Open Pelvis – not needed to fix to control thoracic forces

-As postural correction applied the volume is maintained

Modern Approach

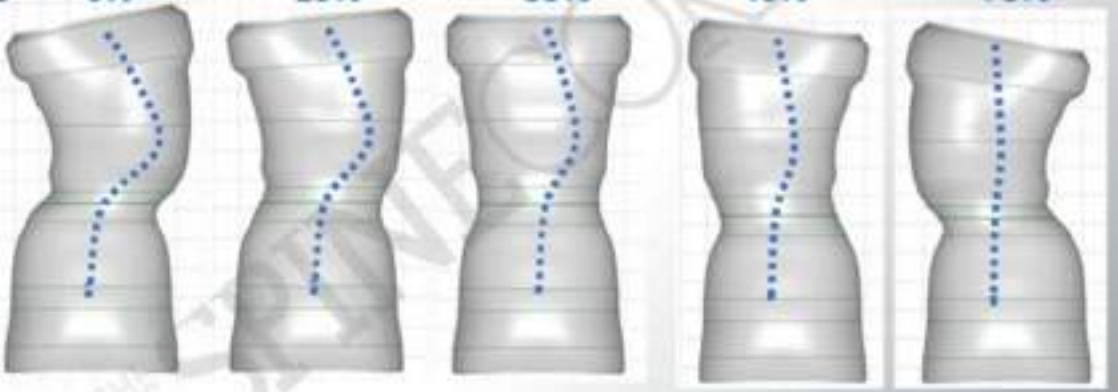


- Shift
- Elongation
- Bend
- Derotation

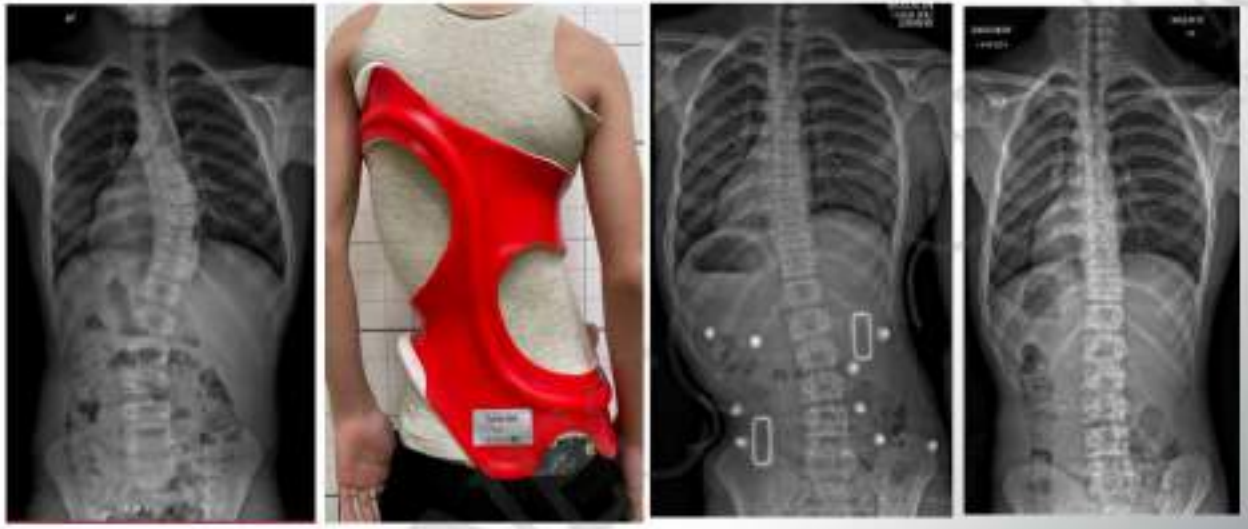
Hypercorrection= Reversing the scoliotic pattern

The Evolution and Future of Scoliosis Brace Treatment

Average IBC 0%----------15%----------35%----------45%----------75%



No Postural Correction | Partial Postural Correction | Neutral Postural-Correction | Moderate Postural Over-Correction | High Postural Over-Correction



The need for specialist design

The need for specialist design

- Due to the complexity and advancement in brace design and correction it has brought the need for scoliosis specialists to design the braces
- Removes the clinical restraints of CAD design time
- Utilises specific classification templates for optimal effectiveness
- Modern over corrective postural bracing done wrong can have
- significant negative implications

  Seen with most common recognised effective scoliosis bracing:
  - Gensingen Brace
  - CMP Brace
  - ScoliBrace

- This does however introduce additional costs

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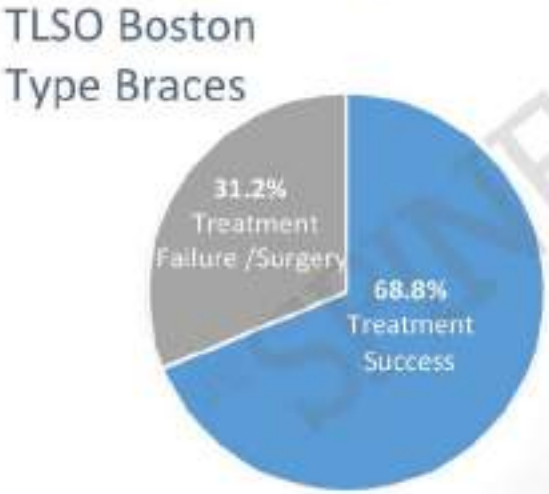
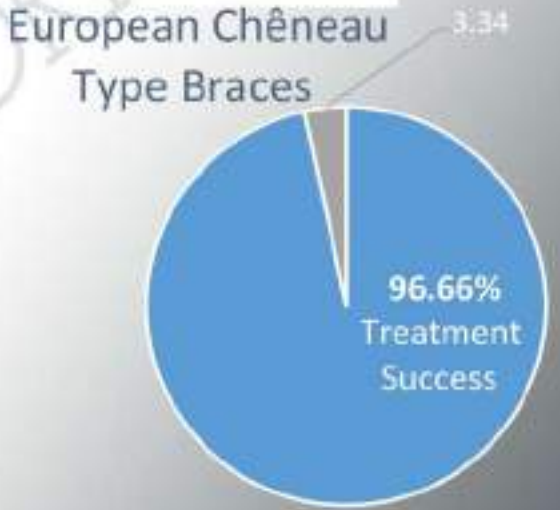
European Spine Journal
https://doi.org/10.1007/s00586-023-08007-6

REVIEW ARTICLE

A comparison between Boston brace and European braces in the treatment of adolescent idiopathic scoliosis (AIS) patients: a systematic review based on the standardised Scoliosis Research Society (SRS) inclusion criteria for brace treatment

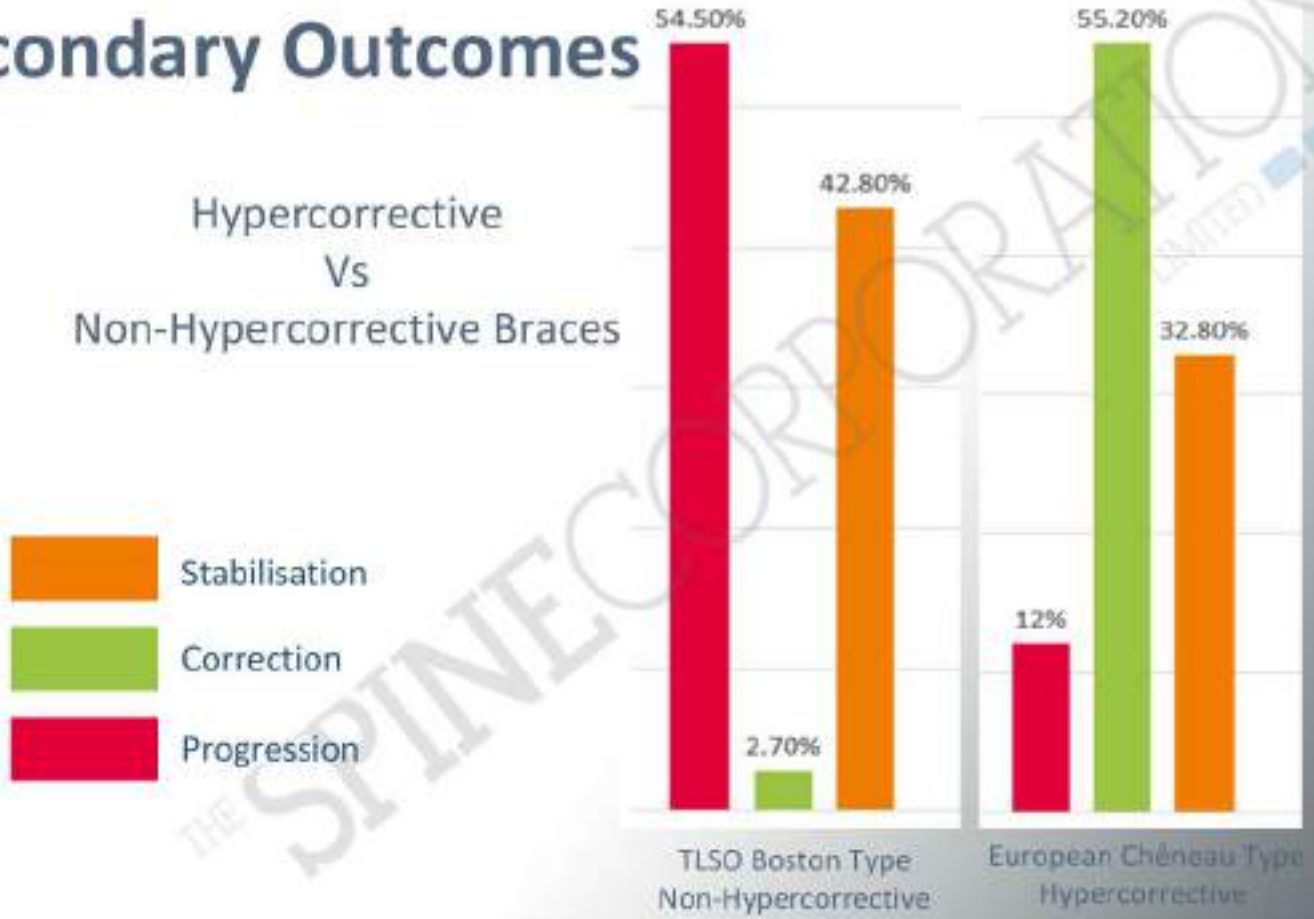
Yu Jie Lee[1] · Wee Jieh Wang[1] · Siti Mariam Mohamad[1] · Josephine Rebecca Chandren[1] · Siti Mariam Abd Gani[1] · Weng Hong Chung[1] · Chee Kidd Chiu[1] · Chris Yin Wei Chan[1]





Secondary Outcomes

Hypercorrective
Vs
Non-Hypercorrective Braces



Importance of Bone Aging

Effective and appropriate treatment relies on accurate knowledge of growth

Removed too early risks progression

Kept in brace longer than required is over treating and can have phycological impact

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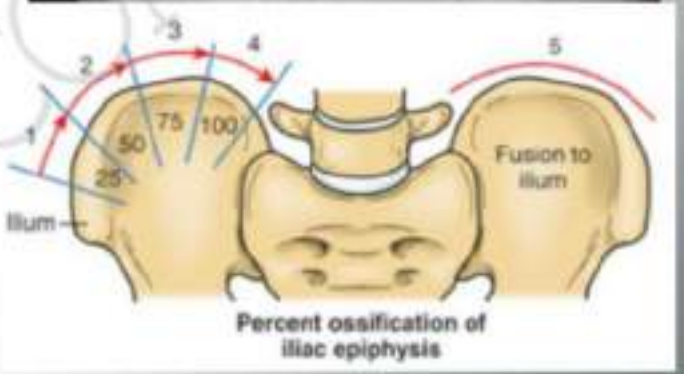
Previously relied on Risser sign to monitor skeletal maturity

Recent evidence suggests this is very unreliable



Sander's Stages

Stage 1: All the digital epiphyses are not covered. The epiphysis is not as wide as the metaphysis, usually most noticeable on the 3rd middle phalanx and metacarpal head.

Stage 2: All the digital epiphyses are covered. The epiphysis is as wide as the metaphysis. The dorsal and palmar surfaces of the metacarpal heads are clearly seen. Some capping of 2-5 proximal phalanges only.

Stage 3: Distal phalangeal physes are closed. Must be completely closed with no gap.

Usually Risser 3

Stage 4: Some of proximal and middle phalangeal physes are closing.

Usually Risser 3 or 4

Stage 5: Most epiphyses cap their metaphyses. The capping is a small bend over the metaphyseal edge. Metacarpals 2-5, heads wider than metaphysis. Epiphyses cap thumb metacarpal and all digits.

Stage 6: Beginning of distal phalangeal physeal closure. Physeal closure starts in the centre of the epiphysis.

Usually Risser 5 + remaining

Stage 7: All physes closed except distal radius and ulna.

Usually Risser 4

Stage 8: All physes closed including distal radius and ulna.

Usually Risser 5

TW3 based on skeletal maturity at:

Girls: 15

Boys: 16.6

BASIS Study

THE BASIS STUDY

We use back braces to treat scoliosis because they can stop the curve to the spine getting bigger and reduce the need for surgery. The BASIS Study is trying to find out which type of back brace is best for treating children and young people with scoliosis.

The BASIS study currently has 326 patients (correct as of 9th August 2024) taking part, across 22 hospitals in the UK. Patients are completing their follow-ups every 6 months, and so far 29 patients have reached the end of their brace treatment. Thank you to all of the patients and their families for continuing to support this study! Further details about BASIS and how to take part, can be found below and on the other pages on this site. Look out for exciting news coming soon about BASIS 2!*

THE BASIS STUDY

BASIS Study

AIM OF THE STUDY

In the UK, children and young people with scoliosis often need to wear a back brace for most of the day to treat the curve to the spine.

Other countries in the world use a different type of brace, worn only at night-time. Before night-time braces can be used routinely in the UK, we need to check they are as good as the braces we currently use.

TREATMENT 1

Full-time Brace: Worn for at least 20 hours each day to hold the curve in place and prevent it from getting any bigger. This is what we currently use in the UK and there is very good evidence it works.

TREATMENT 2

Night-time Brace: Worn for 8-12 hours, only at night. This brace tries to over-correct the spinal curve. It is not routinely used in the UK and there is some evidence it may be as effective as a full-time brace.

BASIS Study

What is being tested?

The BASIS study is comparing the following two braces for patients with adolescent idiopathic scoliosis.

- Full-time brace – this is worn for at least 20 hours per day, and is currently the routine brace type used in the NHS for adolescent idiopathic scoliosis.
- Night-time brace – this is worn only at night, whilst in bed (8-12 hours). The night-time brace is not currently routine and is only available as part of this trial in the UK.

At the moment, we do not know whether the night-time brace is more beneficial than the full-time brace

THE BASIS STUDY

BASIS Study

What this has changed:

- Encouraging bracing in centres previously not active
- Forcing consultants and orthotists to work together
- Standardising protocols across the country
- Ensuring in-brace x-rays
- Centres having to be accountable for their brace effectiveness

What this will show us:

- When is night bracing appropriate
- Are certain curve types, size of curve and age of starting treatment more appropriate for offering part time bracing
- Can we offer options of treatment plan with more idea of end treatment outcome

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Technological Advances

Technological Advances

University of Sheffield

SHEFFIELD SPINE

NHS Sheffield Children's NHS Foundation Trust

BRITISH SCOLIOSIS RESEARCH FOUNDATION

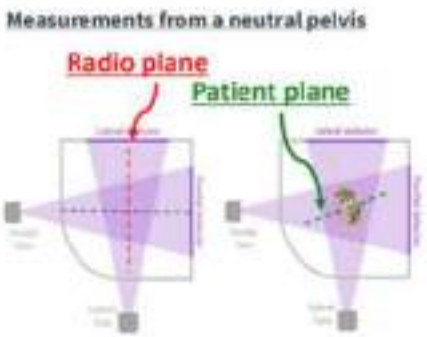
Changes to Rigid Asymmetrical Brace Design after Providing Deformity Measurements from 3D EOS Models in Patients with Idiopathic Scoliosis

M Bellamy, R Jayasuriya, M Nolan, S Hewitt, L Breakwell, A Mills, A Cole

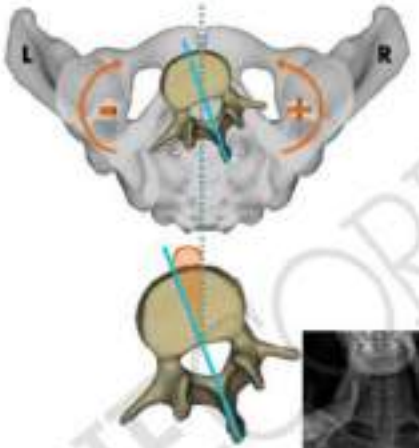
Matthew Bellamy – The University of Sheffield

British Scoliosis Society Congress 2023

Technological Advances



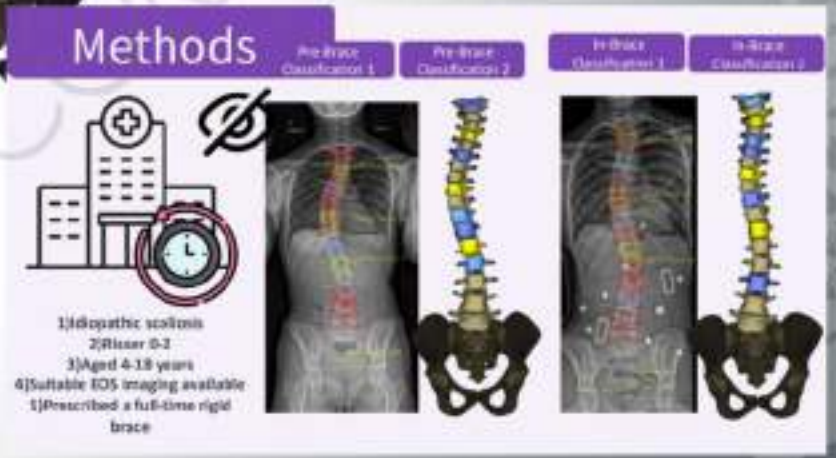
Segmental vertebral measurements from a rotationally balanced pelvis



Technological Advances

Global spinal data from EOS imaging

Methods

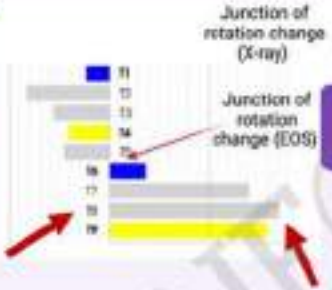


Technological Advances

Results

2D x-ray vs 3D EOS models:
Significant difference in judgment of:

- Maximally rotated vertebrae
- Magnitude of maximal rotation
- Levels of rotational junctions



Summary

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3D EOS Data

Current POCH brace design

Potential new classification and design

4 new braces re-designed

2 Potentially wrong classifications identified

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NHS Sheffield Children's NHS Foundation Trust

Overcoming Costs

Overcoming Costs

Is the higher cost of Postural Over-Correction, Hypercorrective (POCH) Scoliosis Brace Treatment economically justified for the NHS?

Method

A cost comparison was carried out between non-braced and POCH braced patients using surgical rates from BrAIST to calculate theoretical UK treatment costs for both arms.

Retrospective studies, of BrAIST matched cohorts, were completed at JCUH & SCH to establish their surgical rates using POCH bracing.

Average patient treatment costs were calculated based on bracing to skeletal maturity, surgery, or progression to ≥50° surgical marker. These treatment costs were compared with the non-braced cohort from BrAIST to calculate potential cost savings per patient.

Results

Overcoming Costs

Is the higher cost of Postural Over-Correction, Hypercorrective (POCH) Scoliosis Brace Treatment economically justified for the NHS?

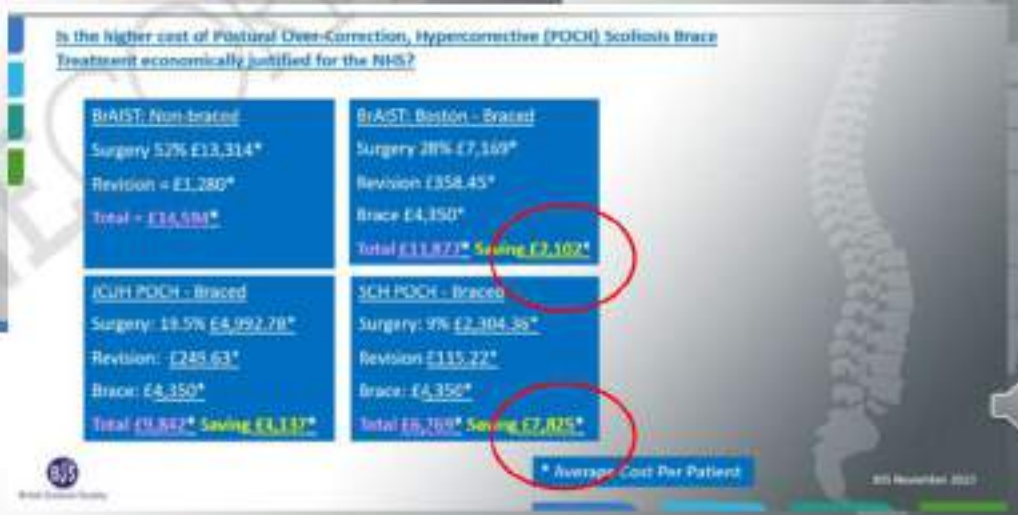
Results -Treatment Costs

Surgery Costs

- Surgery average cost per patient **£25,604** (NHS tariff 2023/4)
- Plus **5%** revision rate for AIS patients

Bracing costs

- Average cost per POCH brace £1,450
- Average 3 braces per treatment episode = **£4,350**



Overcoming Costs

Is the higher cost of Postural Over-Correction, Hypercorrective (POCH) Scoliosis Brace Treatment economically justified for the NHS?

Conclusion

- Cost analysis clearly demonstrates brace treatment reduces surgical rates and treatment costs.
- More Effective POCH Brace treatment
  - ~~53.6%~~ overall NHS cost saving – non-bracing sites
  - 43% overall NHS cost savings at traditional bracing sites
  - ~~Reduced~~ surgery rates
  - Reduced surgery waiting times

Biggest Challenges:

The Biggest Challenge

- Only 10% of patients in UK referred in time for effective brace treatment
- Fewer than 10% of those patients are likely to receive the most efficient type of bracing

The Evolution and Future of Scoliosis Brace Treatment

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Questions?

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