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Preoperative Mechanical Proximal Tibial Angle is Perfectly Correlated to Correction Angle in Medial Open Wedge High Tibial Osteotomy with Mechanical Proximal Tibial Angle-based Surgical Planning

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Faculty Disclosure Information

- **Nothing to disclosure**

Background

- **MPTA, WBL percentage, and HKA angle** are key indicators for calculating correction angle in **surgical planning for MOWHTO.**
- Until now, **no correlation** has been found between the **correction degree** and **MPTA.**
- **No correlation** was found between the **correction degree and MPTA**.
- We **hypothesized** a **perfect linear correlation** between the correction angle and lower limb parameters, particularly **pre-MPTA**. If confirmed, this correlation could have practical applications in surgical planning.

MPTA, mechanical proximal tibial angle; HKA, hip-knee-ankle; WBL, weight-bearing line

Methods

From January 2017 to June 2024

MOWHTOs were performed on 93 lower extremities (91 patients).

- Inclusion criteria:

- Isolated medial compartment osteoarthritis
- Kellgren - Lawrence grade ≥ II
- Varus deformity

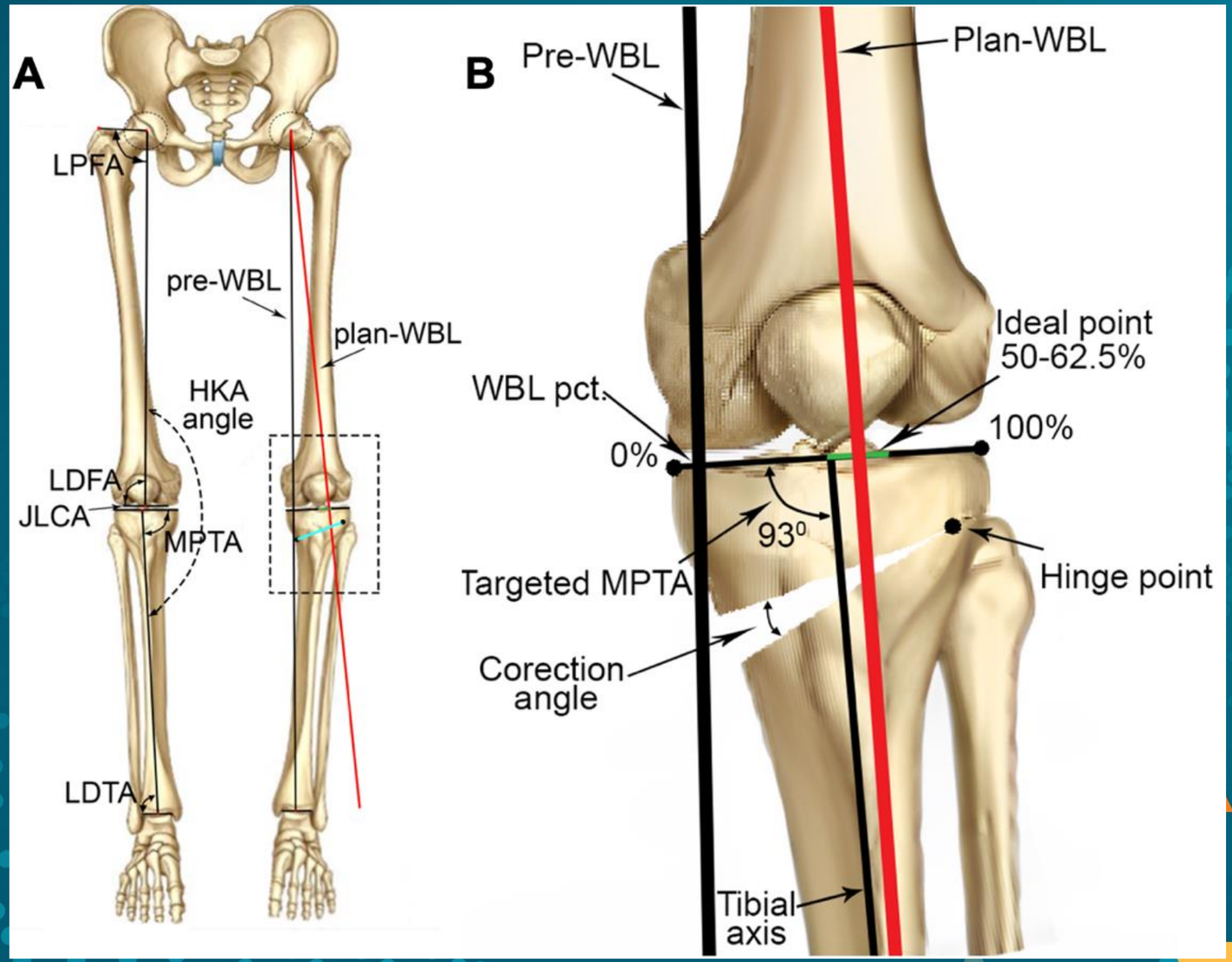
- Exclusion criteria:

- Multi-compartmental arthritis

- Surgical planning utilized computer simulation software that set the correction angle to align MPTA to 93 degrees.
- PSI was designed based on 3D reconstructed CT images.
- Correlation and linear regression analysis bootstrap method were employed.

Preoperative Planning

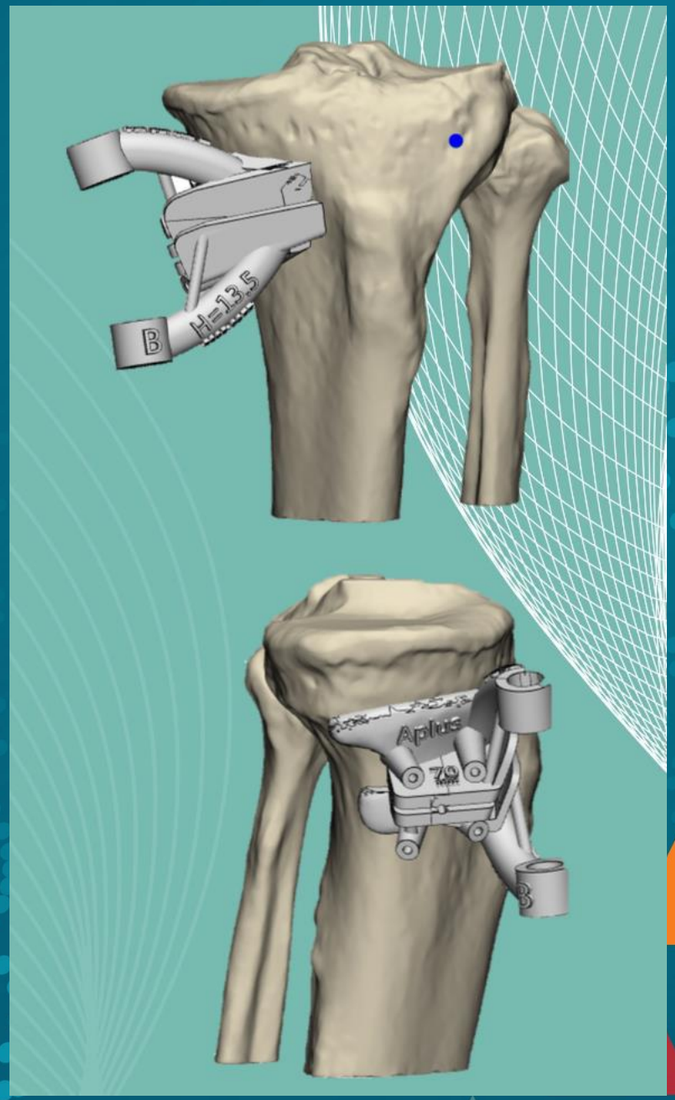
- Preoperative measurements were labelled over the radiograph, such as WBL, MPTA, LDFA, and HKA.
- In the software (MediCAD), approximate **93° of MPTA** was set as the correction target.



Approaches

After approaching to the medial cortex of the tibial the PSI-guide was attached and fixed to the bone. The edge of the cutting slot on the PSI guide was parallel to the lateral hinge. The sawing depth was calculated preoperatively and marked on the length scale of the saw blade.

Osteotomy was then performed by moving a graduated oscillating saw along the cutting slot to create the desired hinge. The osteotomy was gently distracted with a series of osteotomes until it reached the preoperatively planned MPTA



Results

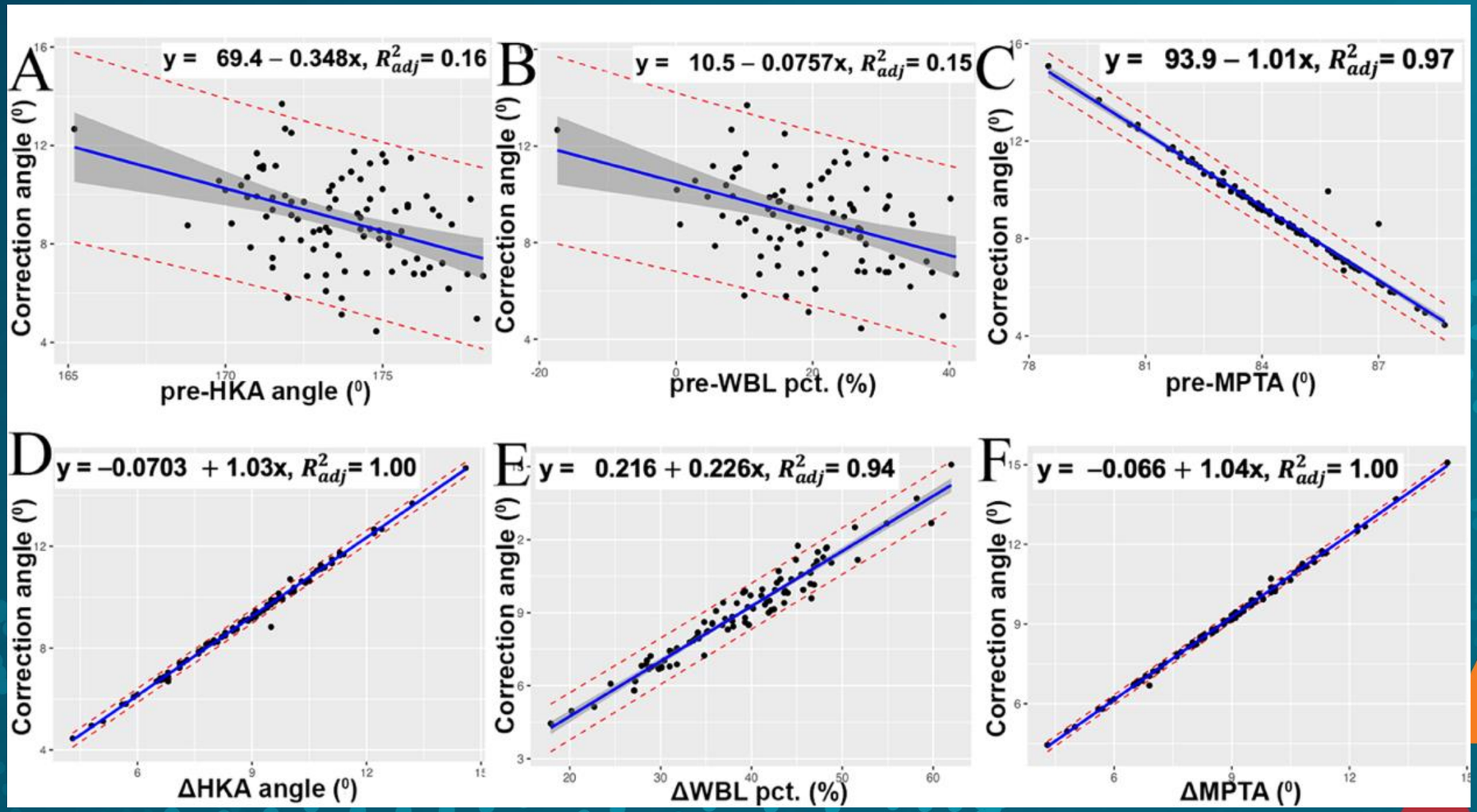
Demographic and radiographic data

	Pre-operation	Surgical Planning	Post-operation	Change	
				(Pre-&Plan-)	(Pre-&Post-)
Mean± Standard Deviation (range in 95% confidence interval)					
Cases (left/right,n)	44/49,93				
Gender (male/female,n)	40/51,91				
Age (yr)	64.2±7.0				
LPFA (⁰)	92.8±5.5		92.7±5.6		
LDFA (⁰)	87.9±2.1		87.9±2.1		
JLCA (⁰)	2.8±2.2		2.2±1.7		-0.6±1.9**
LDTA (⁰)	88.5±3.9	88.4±3.9	88.0±3.9	-0.1±1.1	-0.5±2.8
MPTA (⁰)	84.3±1.9	93	91.9±2.6	8.7±1.9 *	7.4±2.8**
HKA angle (⁰)	173.6±2.3	182.4±2.3	181.7±2.5	8.8±1.9	8.1±3.1**
WBL pct. (%)	19.8±10.3	58.2±10.8	56.2±11.1	38.3±9.3	36.5±13.9 **
Correction angle (⁰)		9.0±2.0			
PTS (⁰)	7.6±2.9		8.2±2.9		0.5±1.4**

*, P < 0.05, **, P<0.01

Results

Conversion formulas to calculate the **correction angle** from **lower limb parameters.**



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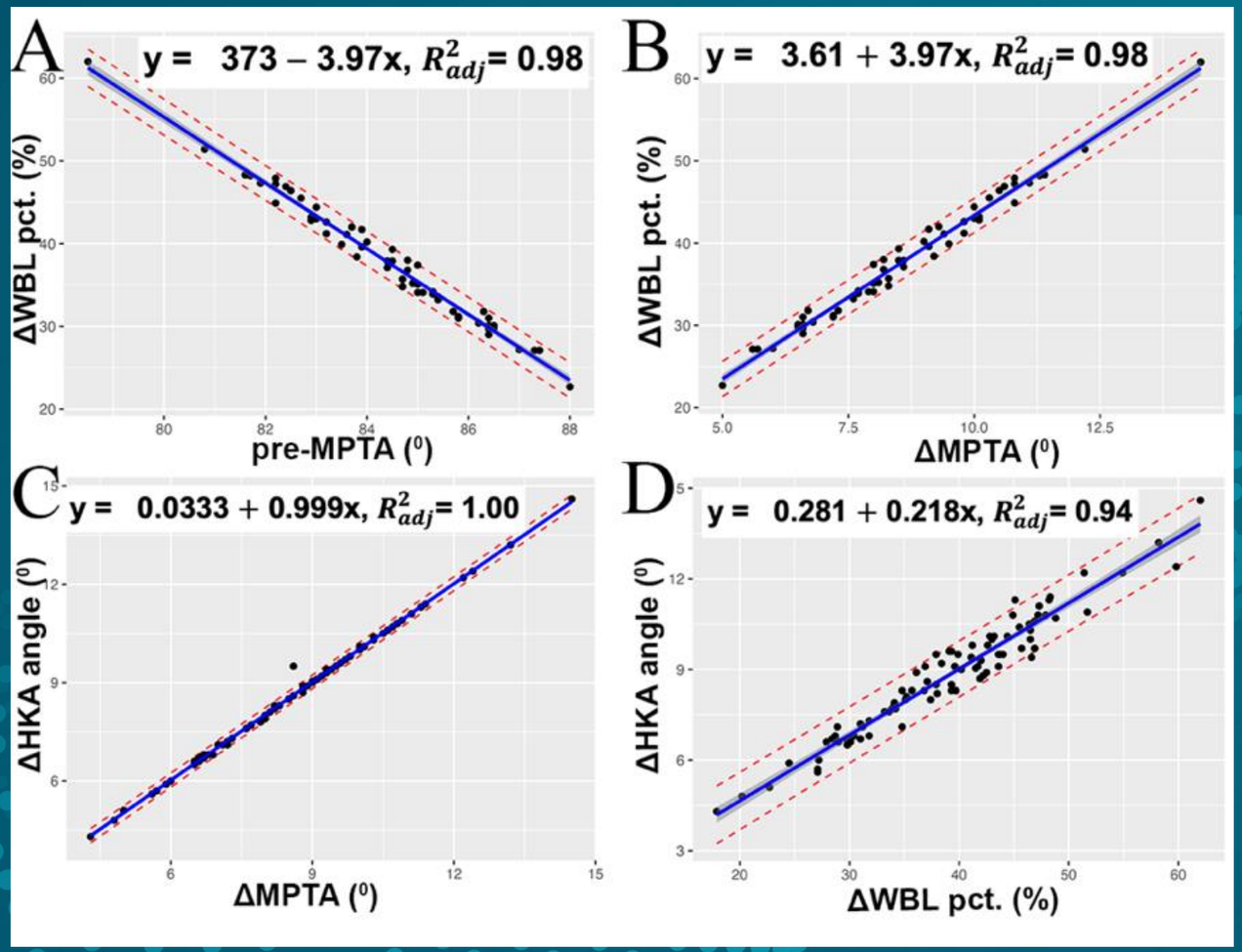
Results

The **perfect correlation** among ΔWBL pct., pre-MPTA, Δ HKA angle, and ΔMPTA.



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Results

Calculated and actual measured parameters show no significant difference.

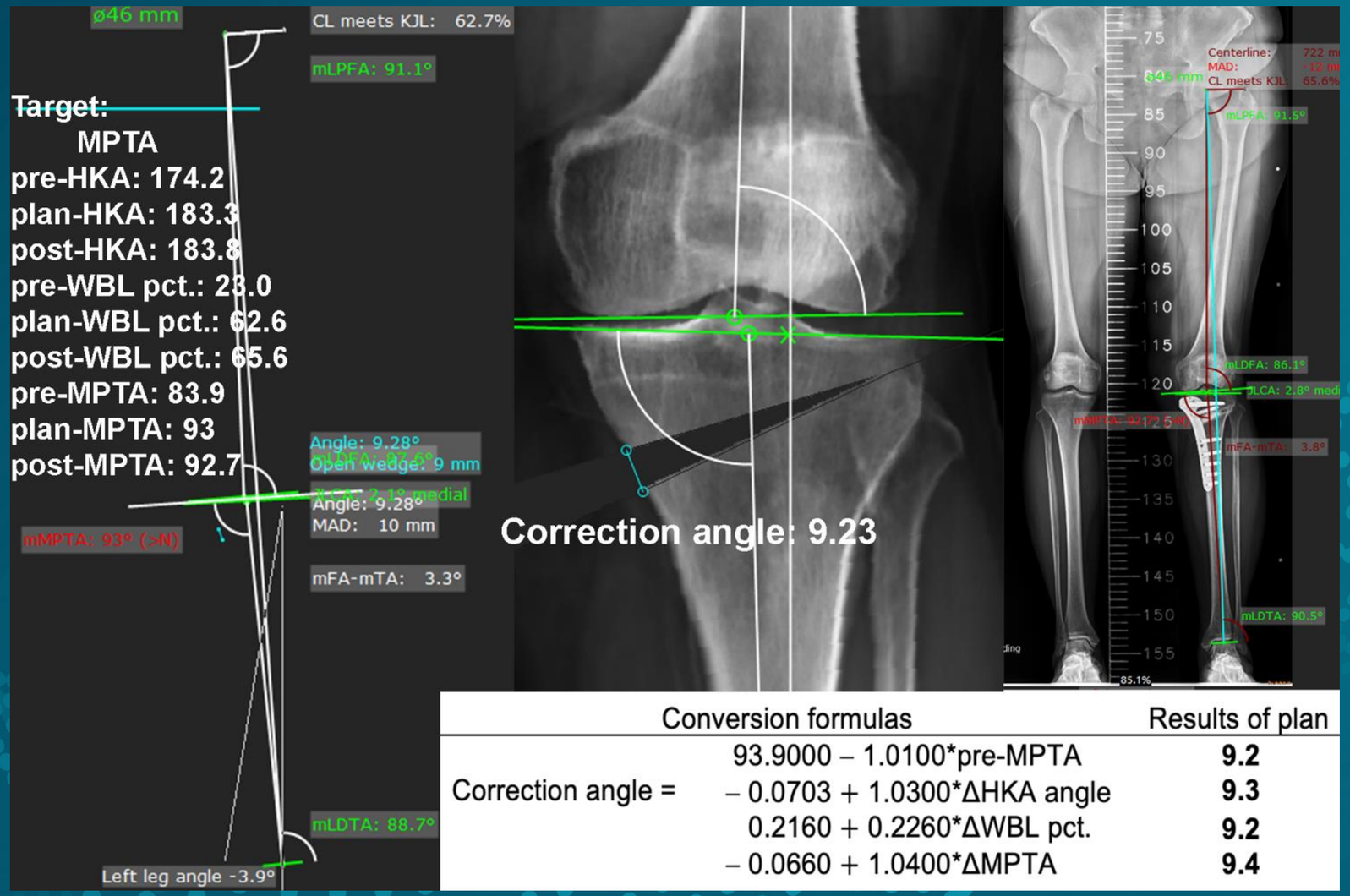
Conversion formula	Actual parameter	Error (95% CI)
MPTA= 93	Post-MPTA (92.5^0 - 93.5^0)	-0.07 (-0.25 ~ 0.13)
Correction angle (based on pre-MPTA)	Correction angle	0.13 (-0.83 ~ 1.18)
Correction angle (based on ΔHKA angle)		-0.18 (-1.29 ~ 0.97)
Correction angle (based on ΔWBL pct.)		0.10 (-0.84 ~ 1.09)
Correction angle (based on ΔMPTA)		-0.06 (-1.10 ~ 0.98)
WBL pct. based on pre-MPTA	Post-WBL pct.	1.25 (-3.36 ~ 6.09)
WBL pct. based on ΔMPTA	Post-WBL pct.	2.20 (-2.66 ~ 6.73)
HKA angle based on ΔMPTA	Post-HKA angle	0.32 (-0.79 ~ 1.51)
HKA angle based on ΔWBL pct.	Post-HKA angle	0.30 (-0.88 ~ 1.57)

Conclusion

- The pre-MPTA, ΔHKA angle, ΔWBL pct., and ΔMPTA are perfectly correlated with **correction angle**, making these correlations useful for practical surgical planning.

- **Conversion formulas** support individualized planning, enabling surgeons to **calculate correction angles** using simple math, even **without digital tools**.

Case example



Conversion formulas		Results of plan
Correction angle =	93.9000 – 1.0100*pre-MPTA	**9.2**
	– 0.0703 + 1.0300*ΔHKA angle	**9.3**
	0.2160 + 0.2260*ΔWBL pct.	**9.2**
	– 0.0660 + 1.0400*ΔMPTA	**9.4**

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