PEGA MEDICAL
WHITE PAPERS

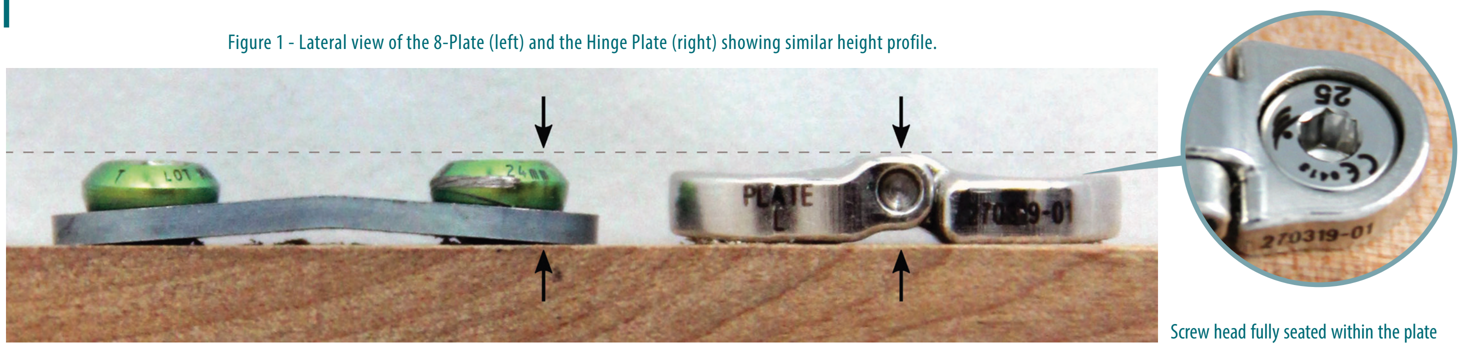
BIOMECHANICS
Hinge Plate™ – Not Thicker but Stronger!

The Hinge Pediatric Plating System by Pega Medical is a fourth-generation implant used to correct angular deformities in pediatric long bones. Clinical studies[1-4] comparing the safety and efficacy of the Hinge Plate to other plate constructs confirm that there is no significant difference in the deformity correction rate among the implant types, as well as no implant-related failures (0 of 77) in the Hinge Plate only.

This paper aims to clarify two common misconceptions regarding the Hinge Plate's unique design: 1) the Hinge Plate is bulkier compared to other plate constructs and 2) its strength is inferior to other plate constructs.

Side-by-side geometric comparison (Figure 1) was performed to compare the height profile of the Hinge Plate to that of a deformable 2-hole plate (8-Plate, Orthofix). Measurements obtained using a height gage revealed that the Hinge Plate and the deformable plate have a height profile of 4.26 mm and 4.03 mm, respectively (5% difference). Attempts to further reduce the profile height compromises the safety of the system.

Figure 1 - Lateral view of the 8-Plate (left) and the Hinge Plate (right) showing similar height profile.



Screw head fully seated within the plate

Additional testing was performed based on ASTM F564 to compare the biomechanical performance (Figure 2) of the Hinge Plate to that of a deformable 2-hole plate, both manufactured in stainless steel.

The biomechanical performance is a function of plate design (Table 1). For the Hinge Plate, the hinge mechanism allows passive plate articulation, rather than deformation such as bending, thus ensuring continuous plate conformity to the underlying anatomy during growth. Consequently, forces generated during growth are transmitted to the hinge mechanism through the screws as purely tensile forces. The Hinge Plate's yield load of 1780N is 20x higher than that of deformable plates and 3.5x higher than the estimated growth forces of 500N. Plastic deformation is inherent to the functionality of deformable plates. This mechanism generates higher stress and creates forces that increase the risk of screw pull-out or cause implant-related failures as reported clinically[5].

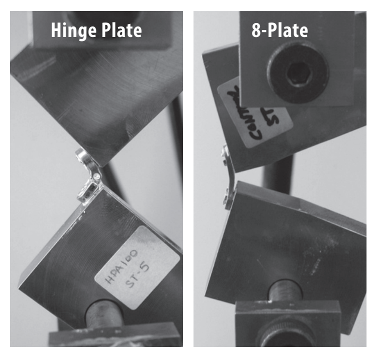


Figure 2 - *Biomechanical test setup.*

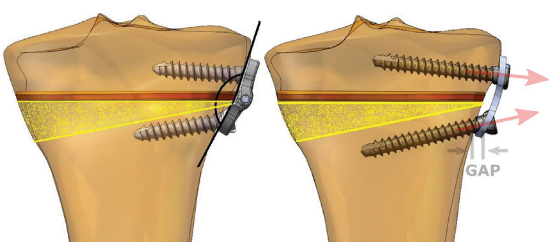


Figure 3 – Simulated tibial growth (yellow).

Figure 3 shows that the Hinge Plate (left) passively articulates to adapt with physis growth over time and continuously conforms to the bone surface without causing additional stress at the screw-bone interface. Deformable 2-hole plates (right) with no mechanical hinge generate higher stress and expulsion forces on the screws.

Combined Tension and Bending	Stiffness (N/mm)	Yield Load (N)
Hinge Plate	1752	1780
8-Plate	13	90
Comparison	132x	20x

Table 1 – Biomechanical test results.

It is evident that the Hinge Plate, with the screw head seated, maintains a low plate profile. Furthermore, the Hinge Plate has sufficient strength to resist forces generated during growth and its unique hinge design ensures continuous plate conformity to the underlying anatomy with growth, thus mitigating the risk of implant failure at the screw-bone interface as reported clinically[1-4].

[1]Kadhim M, et al. (2018) J Pediatr Orthop B, [2] Shin YW, et al. (2016) J Pediatr Orthop, [3]Histov B, et al. (2015) Bul J Ortop Trauma, [4]Chong D, et al. (2014) EPOS, [5] Mahapatra S, Hampannvar A and Sahoo M (2015) Acta Orthop Belg.

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