The Importance of Balance in the Use of Spine Prostheses

Jean-Charles Le Huec, Thibault Cloche, Juan Toussaint, David Abou-Merhi, Laurent Balabaud, Nicolas Pointet and Wendy Thompson

Int J Spine Surg published online 23 March 2025
https://www.ijssurgery.com/content/early/2025/03/21/8742

The International Journal of Spine Surgery
2397 Waterbury Circle, Suite 1,
Aurora, IL 60504, Phone: +1-630-375-1432

International Journal of Spine Surgery, Vol. 00, No. 0, 2025, pp. 1
https://doi.org/10.14444/8742

The Importance of Balance in the Use of Spine Prostheses

JEAN-CHARLES LE HUEC, MD, PHD[1]; THIBAULT CLOCHE, MD[1]; JUAN TOUSSAINT, MD[1]; DAVID ABOU-MERHI, MD[1]; LAURENT BALABAUD, MD[1]; NICOLAS POINTET, MD[1]; AND WENDY THOMPSON, MD[1]

[1]*Polyclinique Bordeaux Nord Aquitaine, Bordeaux, France*

Keywords: lumbar spine, artificial disc

We started implanting lumbar disc prostheses via a minimally invasive anterior approach in 1999 with great enthusiasm but also with a lot of uncertainty.[1] Twenty-five years later, the uncertainty has been lifted thanks to regular monitoring, which has shown the excellent results of these pioneering prostheses (Prodisc L [1999][2] and Maverick [2002][1]).

We have gradually improved the indications by favoring the L4-L5 and L5-S1 levels and by making a hybrid construct first presented at the London Spine Arthoplasty Society meeting in 2003 and published in 2005.[3] The recommendations were the restoration of lordosis by anterior lumbar interbody fusion for L5-S1 and prosthesis in L4-L5. This hybrid construct gives excellent results on long-term follow-up.

We studied a lot, particularly the importance of rebalancing the spine linked to the use of prostheses.[4] Since 2005,[1] we have shown its importance on sagittal balance, with the adaptability of the prosthesis allowing a better economic balance. To continue to improve the indications and justify the use of disc prostheses, particularly in the lumbar region[5] but also in the cervical region, we have extended the static analysis of the spine to dynamic analysis.[6] For 2 years, all patients have been analyzed using a revolutionary system for collecting anteroposterior and lateral spinal alignment using sensors stuck to the skin on predefined cutaneous anatomic spinous processes and associated with a digital twin of the patient based on radiological imaging. Pre- and postoperative EOS imaging is used to create a digital twin, an avatar of the frontal and sagittal alignment, including the lower limbs.[7] This dynamic analysis allows us to better understand the importance of the hip extension reserve, pelvic retroversion, compensatory mechanisms, thoracic kyphosis, and cervical spine position. This can be done while walking but also in a sitting position, which has become a preferred position for many workers. This new analysis allows us to better understand the success of prostheses and also to glimpse new indications. The success story continues.

REFERENCES

1. Le Huec J, Basso Y, Mathews H, et al. The effect of single-level, total disc arthroplasty on sagittal balance parameters: a prospective study. *Eur Spine J*. 2005;14(5):480–486. doi:10.1007/s00586-004-0843-9

2. Tropiano P, Huang RC, Girardi FP, Cammisa FP Jr, Marnay T. Lumbar total disc replacement. seven to eleven-year follow-up. *J Bone Joint Surg Am*. 2005;87(3):490–496. doi:10.2106/JBJS.C.01345

3. Aunoble S, Meyrat R, Al Sawad Y, Tournier C, Leijssen P, Le Huec JC. Hybrid construct for two levels disc disease in lumbar spine. *Eur Spine J*. 2010;19(2):290–296. doi:10.1007/s00586-009-1182-7

4. Mathews HH, Lehuec JC, Friesem T, Zdeblick T, Eisermann L. Design rationale and biomechanics of maverick total disc arthroplasty with early clinical results. *Spine J*. 2004;4(6 Suppl):268S–275S. doi:10.1016/j.spinee.2004.07.017

5. Le Huec JC, Thompson W, Mohsinaly Y, Barrey C, Faundez A. Sagittal balance of the spine. *Eur Spine J*. 2019;PMID(11):1889–1905. doi:10.1007/s00586-019-06128-5

6. Shiba Y, Taneichi H, Inami S, Moridaira H, Takeuchi D, Nohara Y. Dynamic global sagittal alignment evaluated by three-dimensional gait analysis in patients with degenerative lumbar kyphoscoliosis. *Eur Spine J*. 2016;25(8):2572–2579. doi:10.1007/s00586-016-4648-4

7. Le Huec JC. Dynamic sagittal balance analysis. Paper presented at the Proceedings of the 10th Annual International Spinal Deformity Symposium; 2024; New York, NY.

Funding: The authors received no financial support for the research, authorship, and/or publication of this article.

Editor's Note: Dr. Le Huec served as the 2011-2012 president of the International Society for the Advancement of Spine Surgery.

Corresponding Author: Jean-Charles Le Huec, Polyclinique Bordeaux Nord Aquitaine, 33 rue Finlay, 33300 Bordeaux, France; jclehuec1@aol.com