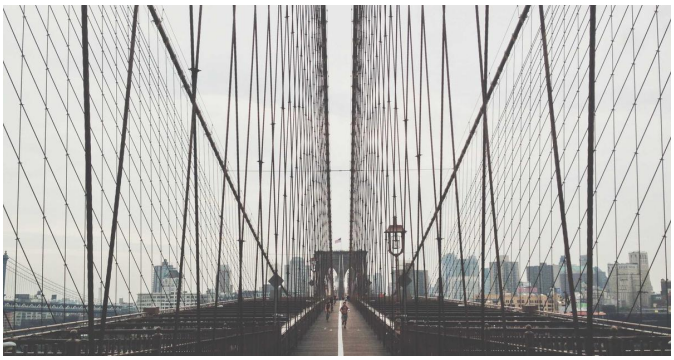
Titanium vs Stainless Steel: Choosing the Right Implant Material

22 July 2026 | by jkadmin



Material selection is one of the most consequential decisions in orthopedic implant design. Ti-6Al-4V titanium alloy and 316L medical-grade stainless steel dominate the market, each with distinct mechanical, biological and economic profiles.

Mechanical Properties

Stainless steel has a Young's modulus of ~193 GPa versus titanium's ~114 GPa — both far exceed cortical bone (15–25 GPa). This mismatch causes stress shielding and potential peri-implant resorption over time. Titanium's superior fatigue limit makes it the preferred choice for intramedullary nails and spine implants subjected to millions of load cycles annually.

Biocompatibility

316L stainless steel achieves corrosion resistance through a chromium oxide passive layer, but ion release (nickel, chromium) has been linked to delayed hypersensitivity in ~1–2% of patients. Titanium's TiO passive layer is thermodynamically stable across the full physiological pH range, releasing negligible ions into surrounding tissue.

MRI Compatibility

Stainless steel implants create extensive susceptibility artefacts that can obscure several centimetres of tissue on standard 1.5T and 3T scanners. Titanium implants produce markedly smaller artefacts; MARS protocols allow diagnostic imaging through most titanium constructs without removal.

Cost

Raw titanium costs 3–4× more than stainless steel. However, total-cost-of-care analysis must include

revision rates (lower with titanium), imaging costs and retrieval procedures. For implants planned for removal within two years, stainless steel remains the economically rational choice.

Contact

- **Address:** 14 Harley Medical Court, London W1G 9PF, United Kingdom
- **Telephone:** +91 9319821922
- **Email:** exports@orthomedimplants.com

This document was generated from https://www.jksigma.in/2026/07/22/titanium-vs-stainless-steel-implants/