

Biological screening before implant placement

Evaluating immunity and inflammation for predictable outcome

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Introduction

Implant dentistry has evolved from a primarily mechanical endeavour into a biologically nuanced intervention that demands careful consideration of systemic health. Increasingly, evidence reveals that immunological readiness and subclinical inflammation are key predictors of successful osseointegration and long-term implant stability.^{1,2,5,7}

Despite impeccable surgical techniques or prosthetic planning, systemic imbalances—such as low-grade inflammation or metabolic dysfunction—can compromise healing, contribute to early implant failure, and lead to long-term complications like peri-implantitis.^{4,8,9} This understanding has ushered in a new paradigm: biologically guided implantology.

This article outlines a practical biological screening protocol for implant placement and introduces emerging systemic biomarkers like the Systemic Immune-Inflammation Index (SII) and the Systemic Inflammation Response Index (SIRI) as powerful predictors of surgical outcomes.^{4,10,12}

Why assess immunity before implant surgery?

Dental implant therapy is not just about replacing a missing tooth, it initiates a cascade of biological events: soft-tissue healing, bone remodeling, vascular ingrowth, and immune cell recruitment. This biologic orchestration determines the success of implant integration.

Even in seemingly healthy individuals, hidden systemic inflammation can:

- Delay soft tissue and bone healing
- Increase marginal bone loss
- Impair osseointegration
- Heighten susceptibility to peri-implantitis
- Result in implant failure^{4,9}

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Calculation of SII and SIRI from routine CBC parameters.

Systemic immune-inflammation and immune response indexes

$$\text{S.I.I.} = \frac{[\text{Neutrophils} \times \text{Platelets}]}{\text{Lymphocytes}}$$

- Neutrophils-markers of acute inflammation
- In both inflammation and tissue repair
- Lymphocytes-represent adaptive immune response

-> Higher S.I.I. values suggest higher inflammation and lower immune competence, which may predict poor surgical outcomes (like delayed healing or higher infection).

Systemic immune response indexes

$$\text{S.I.R.I.} = \frac{[\text{Neutrophils} \times \text{Monocytes}]}{\text{Lymphocytes}}$$

- Monocytes are precursors to macrophages, key in chronic inflammation and tissue remodeling
- This index focuses more on chronic immune activation

-> A higher S.I.R.I. can indicate a prolonged inflammatory state and lower immune control, again predicting poorer postoperative outcomes.

Therefore, screening for inflammatory and immune markers prior to surgery is a proactive step to minimise complications and tailor interventions.

Core biological markers to evaluate

A basic blood panel can offer a wealth of information about the patient's systemic status. Recommended markers include (ranges based on widely used international standards; local laboratory may differ):

- hs-CRP (< 1.0mg/L): Detects chronic, low-grade inflammation
- Vitamin D (25-OH) (40–60ng/mL): Modulates immune and bone response
- HbA1c (< 5.6 %): Reflects glycemic control, critical for wound healing
- Ferritin (30–150ng/mL): Elevated in inflammation; low may reflect poor immunity
- Homocysteine (< 10 µmol/L): Indicator of vascular and methylation status

Advanced immune and inflammatory testing (optional)

In complex or high-risk patients—such as those with autoimmune diseases, history of implant failure, or systemic illnesses—consider:

- Lymphocyte Subsets: CD4/CD8 ratio, NK cell activity
- Immunoglobulin Levels: IgA, IgG, IgM for immune integrity
- Pro-inflammatory Cytokines: IL-1β, IL-6, TNF-α
- Genetic SNPs (e.g., IL-1 Polymorphisms): Correlates with peri-implant bone loss⁶
- Salivary Microbiome Testing: Useful in high-risk periodontal patients

The role of SII and SIRI in implant dentistry

The Systemic Immune-Inflammation Index (SII) and Systemic Inflammation Response Index (SIRI) offer a novel, accessible way to quantify the balance between immune surveillance and systemic inflammation using only routine complete blood count (CBC) values.

Formulas

$SII = (\text{Neutrophils} \times \text{Platelets}) \div \text{Lymphocytes}$

$SIRI = (\text{Neutrophils} \times \text{Monocytes}) \div \text{Lymphocytes}$

These indexes were first proposed in oncology and cardiovascular medicine but are now being evaluated in surgical specialties, including dental implantology^{4,10,12,13}, where immune and inflammatory balance critically influence healing.

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Suggested thresholds

- **SII:** < 600 favourable, 600–1,200 borderline, > 1,200 unfavourable
- **SIRI:** < 1.5 favourable, 1.5–3 borderline, > 3 unfavourable

High values suggest systemic inflammation, which may impair osseointegration.

Note: Normal values vary by population and lab methods; clinicians should interpret within local reference ranges.

"A successful dental implant does not start in the operator— it starts in the blood panel."

Clinical example

In my practice, patients with optimised Vitamin D, hs-CRP < 1 mg/L, and SII < 600 have shown faster soft-tissue healing and reduced early complications. Two cases with high SII (> 1,200) but no acute infection history exhibited delayed healing and early crestal bone changes, supporting the role of these markers as risk indicators.

CBC report for patient X

- **Neutrophils:** $4.8 \times 10^9/L$
- **Lymphocytes:** $2.0 \times 10^9/L$
- **Platelets:** $250 \times 10^9/L$
- **Monocytes:** $0.6 \times 10^9/L$

$$SII = (4.8 \times 250) \div 2.0 = 600$$

$$SIRI = (4.8 \times 0.6) \div 2.0 = 1.44$$

Note that "normal" laboratory ranges vary across countries due to assay differences and population baselines. Clinicians should verify values with their local labs and adjust thresholds accordingly.

Interpretation

- **SII:** < 600 is typically considered favourable for healing.
- **SIRI:** < 1.5 indicates good immune-inflammatory balance.

Values above these thresholds may suggest hidden inflammation, which could compromise healing and increase the risk of complications post-implant surgery.

Application to implant protocol

Incorporate the following stepwise screening process before implant surgery:

1. **Basic Panel (for all patients):** hs-CRP, Vitamin D (25-OH), HbA1c, Ferritin, Homocysteine
2. **SII and SIRI Calculation from CBC:** Helps quantify systemic inflammation and immune readiness
3. **Actionable Interventions:** Correct deficiencies and delay surgery if needed
4. **Monitor Progress:** Repeat tests after four to six weeks if initial values are suboptimal

Biological philosophy in practice

This biological terrain optimisation approach, popularised by thought leaders like Dr Joseph Choukroun, emphasises the importance of preparing the host rather than focusing solely on materials or surgical precision.

His concept of Low-Level Inflammation (LLI) has triggered a global shift toward immune-guided dental surgery. Rather than reactive treatment of complications, biological dentistry promotes proactive correction of hidden dysfunctions.

Conclusion

A successful dental implant does not start in the operator—it starts in the blood panel. Understanding and optimising a patient's biological terrain enhances surgical outcomes, minimises failure rates, and personalises care.

Key takeaways

- Implement a baseline immune-metabolic screen for all implant patients
- Use SII and SIRI as inexpensive, powerful inflammation markers
- Consider delaying surgery in the presence of elevated risk markers
- Collaborate with medical professionals when needed
- Transition from a mechanical to a biologically centered implant protocol

In the evolving field of precision dentistry, biologically informed protocols will no longer be optional—they will become the gold standard.

Literature



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