Peri-implantitis: could the risk begin before surgery?

When we think of peri-implantitis, we tend to think of biofilm, patient-related factors, surgical and prosthetic factors, or maintenance and follow-up strategies. But could part of the problem begin much earlier—before the implant even leaves its packaging?

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A new White Paper from the CleanImplant Foundation focuses on a risk factor that has received comparatively little attention in discussions of peri-implantitis: manufacturing- and packaging-related contamination on new, sterile-packaged dental implants.

The starting point is surprisingly simple: An implant can be sterile and still be contaminated. Sterility describes the absence of viable microorganisms. It does not necessarily mean the implant surface is free of plastic particles, foreign metals, or other residues from manufacturing and packaging processes.

This is precisely where the 16-page White Paper *The Missing Variable in Peri-implantitis* begins. Looking at the issue from four perspectives—science, manufacturers, clinicians, and patients—it raises a central question: Have we underestimated a variable in our search for peri-implantitis risk factors?

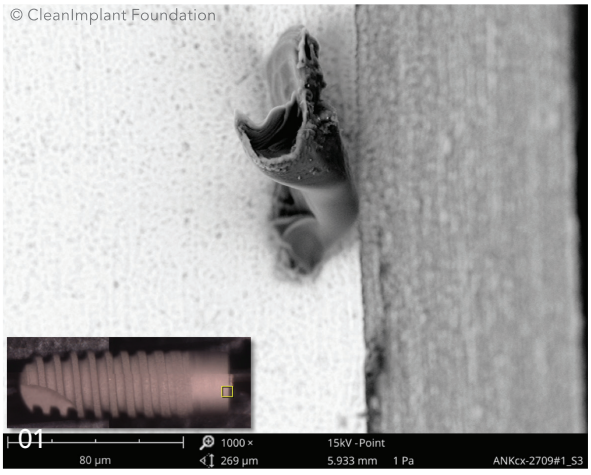
What can be found on new implants?

For years, the CleanImplant Foundation has been examining factory-new, sterile-packaged implants using scanning electron microscopy and elemental analysis. Most recently, an international quality assessment study analysed 80 implants from 55 manufacturers in independent, accredited testing laboratories.

Researchers found significant contamination on one in four implants examined. In these cases, more than 50 organic, i.e. carbonaceous particles were detected on one third of the analysed surface.

The range of substances identified is remarkable. Findings included polyoxymethylene and polysiloxanes, halogenated plastic particles, as well as residues containing tungsten, iron-chromium-nickel, or copper-tin compounds. Film-like contaminants were also detected, including erucamide lubricants, quaternary ammonium compounds, and dodecylbenzenesulfonic acid (DBSA).

This does not mean that a single particle will inevitably cause peri-implantitis. The white paper explicitly avoids suggesting such a monocausal relationship. The more relevant question is: What

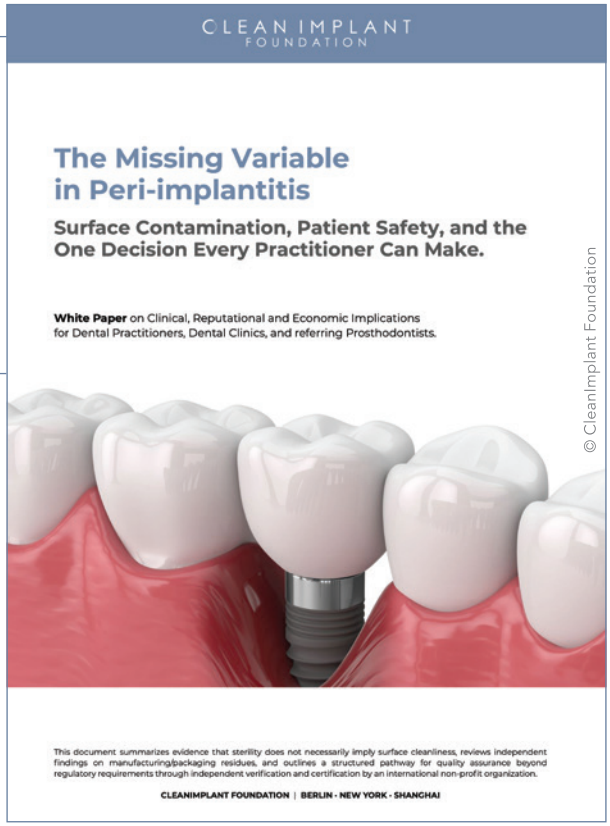


01
SEM image (1,000x) of plastic material at the implant shoulder.

02
Same implant, different location, significant contamination: SEM image (1,000x) of plastic residues at an exposed implant thread. Additional chemical analysis identified synthetic polymers (plastic residue, polysiloxane), residues of dodecylbenzene sulfonate (a cell-toxic surfactant), aromatic and aliphatic hydrocarbons.

For those interested in exploring the data, scientific background, and different perspectives in greater depth, the White Paper *The Missing Variable in Peri-implantitis* is available at: whitepaper.cleanimplant.com

Or simply scan the QR code to read more.



foreign particles on an implant surface may trigger a biological response—particularly during the early phase of healing?

When the body responds to foreign particles

Research has shown that particles within certain size ranges can trigger macrophage-mediated foreign-body reactions. Pro-inflammatory cytokines may promote osteoclast activity, while matrix metalloproteinases can contribute to soft-tissue degradation. Once a rough implant thread becomes exposed, bacterial colonisation may lead to peri-implant mucositis. Without timely intervention, progression to peri-implantitis and potentially implant loss cannot be ruled out.

This is particularly relevant during the sensitive phase of osseointegration, when a technically manufactured implant surface comes into direct contact with biological tissue. Particulate and film-like contaminants could interfere with this delicate balance. For some substances, the concern is evident: DBSA, for example, has direct cytotoxic effects.

The potential relevance of plastic materials originating from implant packaging is currently being investigated in an *in-vitro* study at the University of Zurich, where corresponding contamination effects are being systematically reproduced and analysed.

The good news is that these residues are not unavoidable in modern dental implants. With controlled manufacturing, cleaning, and packaging processes, the contaminants described can, in principle, be technically avoided—consistently across production batches.

A risk factor clinicians can influence

Many factors affecting the long-term success of implant therapy can only be influenced to a limited extent. General health, genetic predisposition, and patient compliance are obvious examples. The choice of implant system, however, is actively made before surgery. Surface quality should therefore also be considered an integral part of quality assurance in clinical practice.

The CleanImplant Foundation awards its "Trusted Quality" seal to implant systems that demonstrate consistent surface cleanliness across production batches and beyond minimum regulatory requirements. The assessment is based on clinical data, independent analyses conducted by accredited testing laboratories, and a peer-review process that must be repeated every two years to maintain the award.

This raises a fundamental question for every implant dentist: What objective evidence of surface cleanliness is available for the implant system I use in my practice? Selection criteria, procurement decisions, and patient communication should be documented transparently—not least in view of potential medico-legal implications.

The White Paper does not offer a simplistic equation of "contamination causes peri-implantitis." Instead, it draws attention to a surprisingly rarely asked question: What is actually present on an implant when the sterile packaging is opened?

Discuss with the CleanImplant project experts at the EAO Congress in Lisbon. Meet us at booth F25.

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About the foundation