

Titanium particles may be a possible cause of dental implant failure

Researchers find evidence that dental implant failure may be caused by leakage of titanium particles from implants into surrounding bone.

Dental implants have been historically used for thousands of years to replace teeth for both functional and aesthetic reasons. While the modern use of titanium in implants since 1965 has improved the long-term success of implants, their failure rate remains as high as 5–10% due to loss of the bone in the area surrounding the implant. The mechanisms for this bone loss remain unclear; some researchers believe that bacterial infections are the cause, while others suspect low vitamin D levels. One recently proposed potential cause is the leakage of microscopic titanium particles from the implant into the surrounding bone, and the immune response and inflammation that follows. While scientists have indeed observed titanium leakage from implants, the potential for this to contribute to dental implant loss has been unclear, until now. A recent study by Dr. Dehua Li and colleagues from The Fourth Military Medical University in Shaanxi, China, sheds new light on this question. According to Dr. Li, “the findings of this study confirm that titanium particles can indeed contribute to bone loss and reveal some of the processes involved.”

In their study, the findings of which are published in the *Journal of Periodontal Research*, the effect of titanium particles was investigated in rats that were given titanium implants. After implantation, some of the rats were injected with additional titanium particles around the implant to simulate high levels of titanium leakage. In addition, some rats were also given the drug clodronate to suppress “macrophages”, a type of immune cell. This allowed the researchers to study both the effects of titanium particles and the influence of the immune system on bone loss.

The authors found that compared to rats that received implants but no extra titanium particles, rats injected with titanium particles experienced increased bone loss around the implant, as well as other features consistent with an inflammatory immune response in the implant area, such as an increased presence of macrophages associated with inflammation, and an increased production of “proinflammatory” molecules that promote inflammation. However, when this injection of titanium particles was accompanied by clodronate injection, the immune response was suppressed, reducing the presence and production of proinflammatory macrophages and molecules.

Even more importantly, cotreatment with clodronate slowed the loss of bone following the injection of titanium particles, indicating that the negative effect of the titanium particles was dependent on activation of macrophages. In the future, Dr. Li notes that “Additional research is needed to determine whether titanium particles and the subsequent immune response are the only factors that induce bone loss or whether other processes may act alongside these.” Despite this, the results of this study confirm that leakage of titanium particles from dental implants can induce inflammation that contributes to implant failure and provides insight that could lead to new treatments to improve implant success.

Reference

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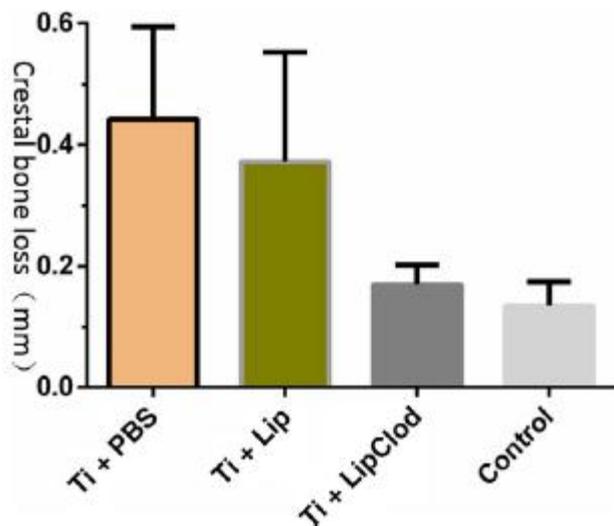


Figure 1. Bone loss in rats following injection with titanium and clodronate.

Injection of titanium particles along with phosphate-buffered saline (Ti+PBS) or empty liposomes (Ti+Lip) increased bone loss around dental implants compared to that in rats with no titanium injected (Control). However, injection of titanium with liposomes containing the drug clodronate (Ti+LipClod) reduced bone loss to control levels.