

Histologic Findings within Peri-implant Soft Tissue in Failed Implants Secondary to Excess Cement

Report of Two Cases and Review of Literature

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ABSTRACT

A link has been established between peri-implant disease and excess cement extrusion in cement-retained implant restorations. The histologic findings of two patients with failed implants secondary to residual excess cement are reported here. If excess cement is detected early and adequately removed, resolution can occur in the majority of situations. Simple recommendations are proposed, with the intention of preventing further implant failures from residual excess cement.

Cementation of an implant prosthesis is an accepted protocol. Advantages include less demanding surgical placement of the implant, simpler laboratory techniques, passive fit, esthetics and control of the occlusion.¹⁻² Disadvantages are unpredictable retention and resistance, and the detrimental effect of cement flow into the soft tissues that can be difficult to remove.²

The soft tissue attachment onto the implant surface is more delicate than that seen at the natural tooth surface due to the lack of Sharpey's fiber insertion, the reduced number of collagen fibers and the direction in which these fibers run.²⁻³ Cement extrusion into the sulcular area may result in soft tissue swelling, soreness and bleeding, or exudation on probing.^{2,4} In some

instances, the excess cement has been considered the cause of implant failure.^{2,5}

We report here on two cases of failed implants with histologic evidence of excess cement within the soft tissue surrounding these implants and foreign body inflammation. The intent of this publication is to increase awareness of the detrimental effects of incomplete cement removal or residual excess cement, and to provide clinicians with simple recommendations to minimize further implant failures.

Case Reports

Case One

In June 2009, a 44-year-old female in good general health was referred by her general dentist to an oral and maxillofacial surgeon for extraction of the mandibular left first molar (#19) (Figure 1A). The treatment plan was to extract tooth #19 and immediately place a dental implant. After local anesthesia was obtained, the tooth was atraumatically extracted. The surgical site revealed an inadequate amount of alveolar bone for the planned procedure and, thus, the decision was made to place freeze-dried human bone graft material (*OraGraft*; *Life Net Health*) in the extraction socket and postpone placement of a dental implant for several months.

The patient returned to the office in March 2010 for evaluation of the previously placed graft in the edentulous area of tooth #19 and implant consultation (Figure 1B). The patient was ad-

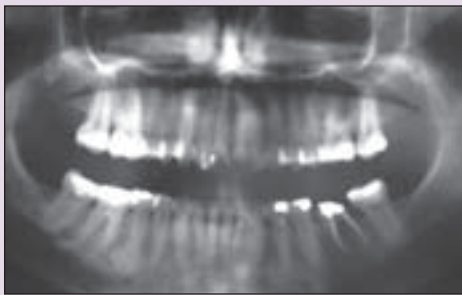


Figure 1A. Case One preoperative radiograph. Taken in June 2009 of endodontically failed tooth #19.

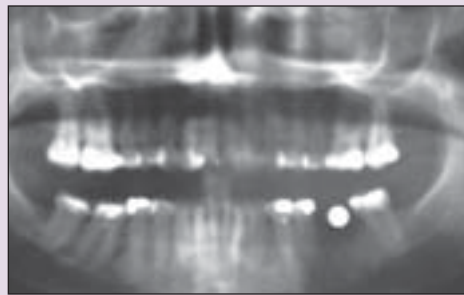


Figure 1B. Post-extraction radiograph with replacement bone graft of edentulous #19 area left mandible. Radiograph taken March 2010.

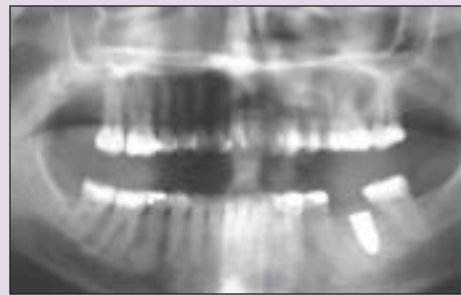


Figure 1C. Post-insertion radiograph taken Aug. 26, 2010, of Nobel Biocare replace select screw implant.

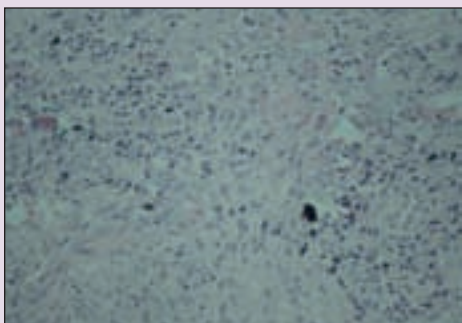


Figure 1D. Hematoxylin and eosin-stained section (20x magnification) demonstrating multiple foci of black exogenous cement deposits in several areas. Stroma is highly vascularized fibrous tissue and contains scattered acute and chronic inflammatory cells.

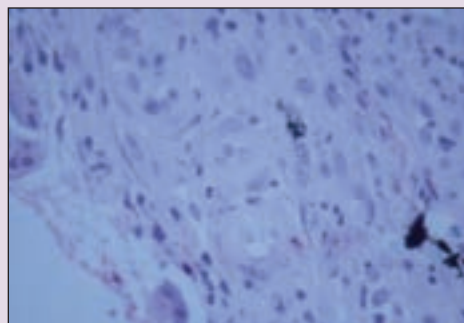


Figure 1E. Hematoxylin and eosin-stained section (40x magnification) demonstrates multinucleated giant cells and foci of black cement particles within fibrous tissue stroma. Scattered inflammatory cells are also noted.

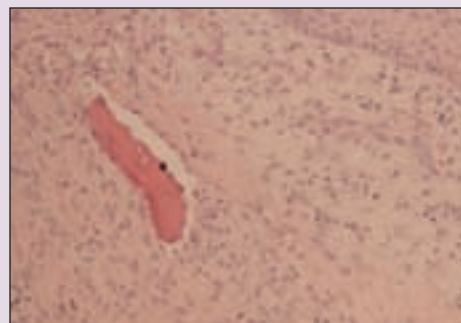


Figure 1F. Hematoxylin and eosin-stained section (10x magnification) shows squamous surface mucosa overlying inflamed fibrous tissue and spicule of residual necrotic bone.

vised to wait an additional six months. On August 26, 2010, the patient returned to the oral and maxillofacial surgeon for implant placement. A Nobel Biocare replace select implant (*Nobel Biocare; Yorba Linda, CA*) was inserted (Figure 1C) in the edentulous space #19. The implant was allowed to heal for four months. In December 2010, the patient returned to her general dentist for restoration of the implant. A ceramo-metal crown was subsequently fabricated and cemented.

On October 14, 2011, the patient returned to the practice of the now-deceased oral and maxillofacial surgeon with excessive bone loss and granulation tissue around #19 implant. The implant was removed, along with the friable surrounding soft tissue and osteotomy contents, which were placed in a bottle of 10% formalin and sent to the oral and maxillofacial pathology laboratory for histopathologic evaluation.

Hematoxylin and eosin-stained sections of the specimen (Figure 1D) revealed foci of black amorphous exogenous cement scattered throughout the fibrous stroma. These foci were accompanied by an acute and chronic inflammatory cell infiltrate and multinucleated foreign body type giant cells (Figure 1E). Surface mucosa overlying inflamed fibrous tissue containing a spicule of residual necrotic bone (Figure 1F) was also noted. The final pathology report included a diagnosis of acute and chronic inflammatory reaction with foci of exogenous matter consistent with cement. The ICD-9 code for foreign body granuloma accompanied the diagnosis.

Case Two

In January 2006, a 57-year-old male presented to an oral and maxillofacial surgeon. He had been referred by his general dentist for placement of dental implants in the edentulous right mandible. Two implants (*Nobel Biocare replace select*) were placed in the edentulous right mandible in the area of the second premolar and second molar sites (Figure 2A).

Four months after the implants were placed they were evaluated for clinical integration (Figure 2B). The patient returned to the general dentist for fabrication of abutment crown restorations. Individual ceramo-metal crowns were fabricated and cemented onto the implants.

On October 26, 2011, the patient presented with excessive bone loss around a failing implant at the mandibular second molar site. This implant was removed, along with the hyperplastic soft tissue surrounding the failed implant, which was placed in a bottle of 10% formalin and sent to the oral and maxillofacial pathology laboratory for histopathologic examination. A bone graft using a mineralized allograft material (*Puros; Zimmer Dental, Warsaw, IN*) was placed in the surgical defect (Figure 2C) for a future implant.

Hematoxylin and eosin-stained sections of the tissue (Figure 2D) showed scattered foci of black particulate exogenous cement material throughout the inflamed fibrous tissue stroma. The final pathology report included a diagnosis of acute and chronic inflammatory reaction, with foci of exogenous matter, consistent with cement, and ICD-9 coded for foreign body granuloma.

Discussion

The cemented crown was introduced for esthetic reasons and to compensate for loosening problems encountered with screw-retained restorations^{4,6} The initial disadvantage associated with cemented restorations was lack of retrievability when problems occurred that required crown removal. Another problem is the difficulty associated with visualization and with removing excess cement at the crown margins.⁴ Residual excess cement (REC) is a common complication of cement-retained prosthesis and has been linked to peri-implant disease,⁷⁻⁸ which can result in a local inflammatory process and has been documented as a cause of peri-implant disease.^{2,5}

In a published study by Wilson,⁹ peri-implant disease was first diagnosed in test implants loaded from four months to more than nine years after cementation of single-unit fixed partial dentures. Case Two in our series occurred five and a half years after final cementation. Wilson⁹ noted that if the REC is identified and adequately removed, resolution of peri-implant disease can occur in the majority of situations. The proposed etiology for the peri-implant disease in the Wilson study was bacterial colonization of the cement; however, in the two examples cited in our case report, it may well be due to a foreign body reaction.

Prevention of cement extrusion during the restoration process beyond the restorative cement margins cannot be underestimated; however this may be more difficult than it appears.¹⁰ In vitro model systems have demonstrated the difficulty in controlling and removing REC by visual and tactile means,¹¹ even when supra-gingival crown/abutment margins were placed.¹²

Radiographic evaluation allows for a non-invasive evaluation of the site, with the potential to locate REC. Detection is influenced by factors such as composition of the cement, amount and site.¹³⁻¹⁴ Other disciplines within dentistry have required radiopacity specifications for cements.¹⁵ No mandatory minimal standard specifications exist for implant cements.¹⁶

The radiopacity of some commonly used cements has been documented, and a large variability in radiographic detection ability was reported.¹³ Some cements have high radiographic density, which allows for easy radiographic detection; others cannot be detected even at 2 mm thickness.¹⁰ The radiographic material varies directly with the third power of the atomic number of the absorber elements.¹⁴ For this reason, the zinc found in zinc phosphate and zinc oxide eugenol cements is highly detectable. This is in contrast to the low atomic number elements found in acrylic urethane cements, which are difficult to detect radiographically unless the manufacturer purposefully adds agents containing higher atomic numbers to increase the radiopacity.

The failure of complete seating of the crown during cementation has also been reported.⁹ In this situation, excess cement is allowed to be extruded during placement. This can occur for several reasons, including too much cement placed within the crown, tight proximal contact, tight fit of the crown, inadequate

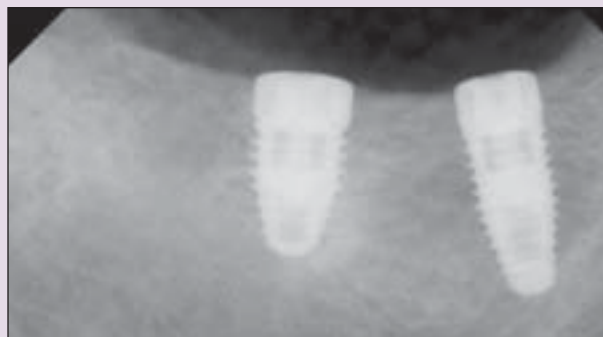


Figure 2A. Case Two radiograph taken January 2006 following insertion of screw dental implants #29 and #31.



Figure 2B. Radiograph taken before prosthetics; April 2006.



Figure 2C. radiograph taken October 2011 following removal of failed implant #31 and replacement bone graft for future implant.

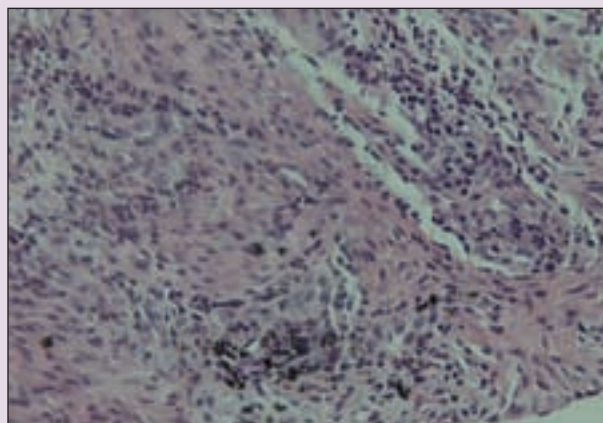
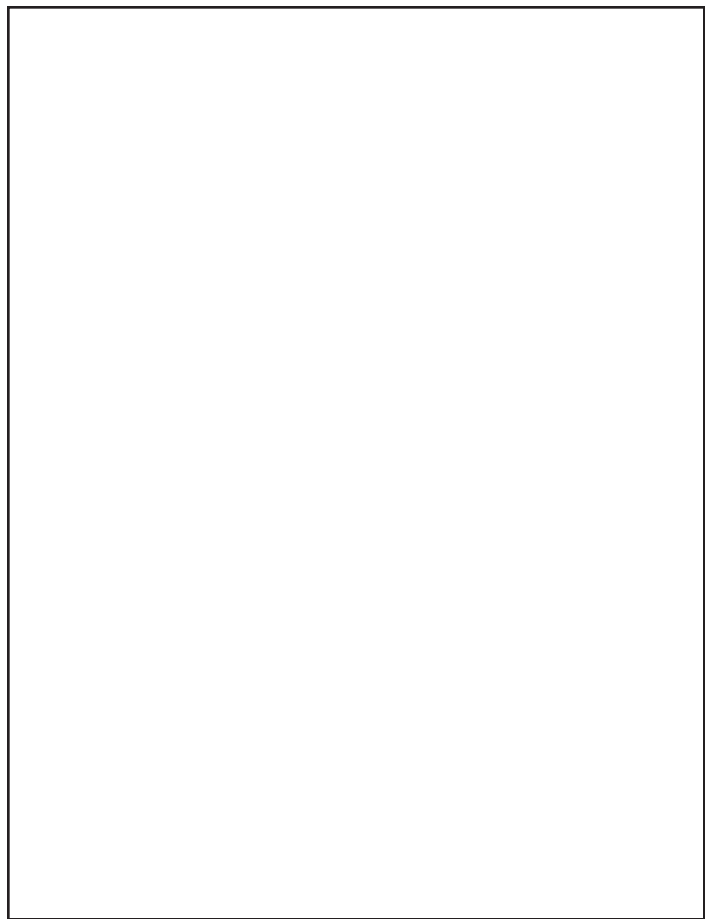


Figure 2D. Hematoxylin and eosin-stained section (20x magnification) depicts highly vascularized fibrous tissue containing several foci of black exogenous cement particles and scattered acute and chronic inflammatory cells in stroma.

cement space, not following cement manufacturer's recommendations regarding working and setting time and inadequate pressure application while seating the crown. Some of these issues are readily highlighted with a pre-cementation radiograph, allowing for corrective adjustment and complete seating.

Comparison of a post-cementation radiograph with a pre-cementation film can be useful for visualizing incomplete seating of the crown and for providing a means of determining if residual excess cement is present, given that the cement is radiopaque enough and at a site that allows for detection.

The importance of postoperative appointments for implant patients following cementation of the restoration cannot be over-emphasized.⁴ A recommendation of one week, followed by one-month, three-month and six-month postoperative appointments following cementation of prosthesis has been proposed.⁴ Should peri-implant complications suggest the possibility of residual excess cement, treatment would include conservative exploratory surgery to confirm initial diagnosis and to evaluate the extent of the problem; removal of the excess cement; and replacement of the existing restoration, if indicated, to restore the health of the surrounding tissues.⁴



Summary

This article describes two patients with failed implants secondary to REC and the histologic findings of foreign body inflammation and foci of exogenous cement within the tissues surrounding the failed dental implants. By understanding the issues, the clinician may be able to more readily diagnose problems early and gain clearer understanding of an important factor when selecting a cement for implant restorations, that is, the ability to readily detect excess cement with intraoral radiography. If detected early and adequately removed, resolution of peri-implant disease can occur in most cases. //

Queries about this article can be sent to Dr. Ramer at Naomi.ramer@mountsinai.org.

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