Complications Associated with Excess Cement Around Crowns on Osseointegrated Implants: A Clinical Report

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The potential advantages and disadvantages of cement-retained implant crowns are reviewed, with a focus on complications related to residual excess cement. A series of 4 case reports illustrates the symptoms and treatment modalities associated with excess cement around implant crowns, and suggestions are offered for the prevention of such problems.
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Key words: cement-retained implant crowns, complications, excess cement

Implant-supported crown restorations may be retained either by retrievable screws or cement. Screw-retained restorations offer a rigid connection between the restoration and the abutment, as well as retrievability, but they are usually more expensive because of the extra components and laboratory costs.[1] More important, screw-retained crowns have exhibited evidence of screw loosening in 50% of restorations during the first year in function,[2] a phenomenon that was also observed in 43% of single-tooth implant crowns.[3] To improve screw joint stability, gold alloy–retained screws were developed, which allowed a greater preload than commercially pure titanium screws.[2,3] The use of torque controllers and specially designed screws for CeraOne implant restorations (Nobel Biocare Canada, North York, Ontario, Canada) for example, appear to reduce the frequency of loose screws.[4]

The cemented crown was first introduced for esthetic reasons and to compensate for screw loosening problems encountered with the screw-retained restorations.[1] The initial disadvantage associated with cemented restorations was the lack of retrievability when problems occurred, which required crown removal. Another potential problem is the difficulty associated with visualizing and removing excess cement at the crown margin. However, there is little information in the literature about the effects of excess cement on peri-implant tissues.

This report presents 4 patient situations illustrating complications that may arise following the cementation of crowns on successfully osseointegrated implants. Possible reasons for such complications and recommendations for treatment are discussed.

Case Reports

Case #1. An 18-year-old male presented with a severely resorbed maxillary left lateral incisor, and the recommendation of an implant-supported replacement was discussed. A single 3.75 × 15-mm Brånemark implant was placed at the time of tooth extraction, and an expanded polytetrafluoroethylene (e-PTFE) membrane (W. L. Gore, Flagstaff, AZ) was used to generate bone around the implant neck. The e-PTFE membrane was removed after 8 weeks because of membrane exposure. Healing during the remaining integra-

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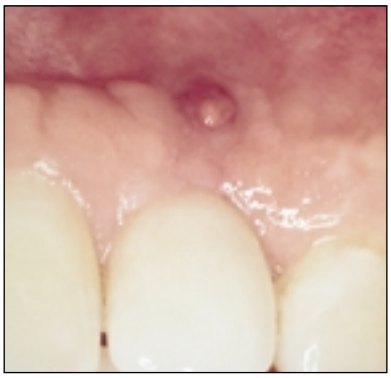

Fig 1a Maxillary left lateral incisor with buccal swelling and purulent discharge.

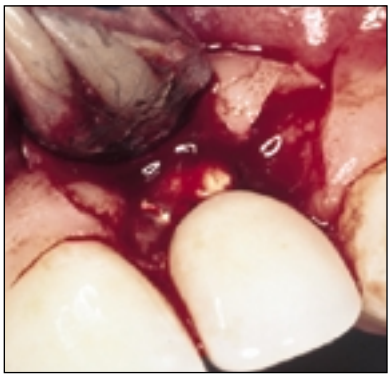

Fig 1b Excess cement noted at implant-abutment interface of same tooth.

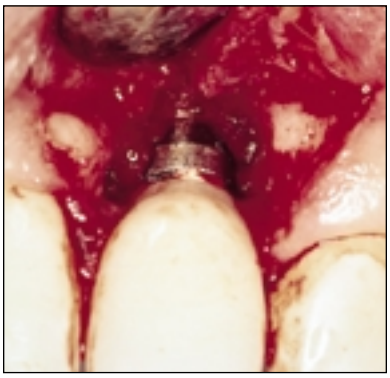

Fig 1c Excess cement was removed and the area debrided.

tion period was unremarkable, and at the time of abutment placement, complete bone coverage was noted, extending over the cover screw of the implant. A CeraOne abutment was placed, and the tooth was then restored with a single all-ceramic crown. The patient was lost to recall for almost 4 years, and when next seen he demonstrated a localized purulent swelling of the facial aspect of the peri-implant soft tissue (Fig 1a). Consultation with his general dentist revealed that the implant crown had been displaced some weeks previously and had been recemented. He related that it was difficult to seat the crown at cementation. A flap was raised in this area, and an excess of zinc phosphate cement was noted around the circumference of the implant (Fig 1b). The crown was found to be incompletely seated but was resistant to removal. The excess cement was removed, and the flap was replaced (Fig 1c). Soft tissue healing was uneventful. Replacement of the crown was recommended.

Case #2. A 23-year-old male presented for implant restoration of a missing maxillary central incisor, which had been lost as a result of trauma. A single Brånemark implant was placed, measuring 3.75 × 15 mm, and after a 9-month integration period, a CeraOne abutment was placed. The implant was subsequently restored with a crown cemented with Fuji II glass-ionomer cement (GC International, Kitchener, Ontario, Canada). Some weeks later, the patient presented with an acute swelling of the gingival tissues around the implant crown (Fig 2a). A 9-mm probing defect was noted facially, and marginal bone loss was seen on radiographic examination. On exposure of the area by flap procedure, a small excess of cement was noted at the abutment-crown interface (Fig 2b). This excess was removed, and the flaps were replaced (Fig 2c). Subsequent healing was uneventful, although some gingival recession was noted. The implant remains integrated, and there have been no further complications.

Case #3. A 41-year-old female presented for replacement of the right maxillary lateral incisor. A single 3.75 × 15-mm Brånemark (Nobel Biocare, Canada) implant was placed in the site of the missing tooth. Because of difficulty in scheduling the patient, integration time continued for 12 months, following which a CeraOne abutment was placed. This was subsequently restored with a CeraOne crown cemented with Fuji II cement. Five months later, the patient presented with swelling in the facial gingiva over the implant area. Probing depth at this site was 6 to 7 mm, and some marginal bone loss was visible radiographically. A flap was raised and excess cement was visible at the crown-abutment interface, with associated marginal bone loss. An e-PTFE membrane (Gore-Tex, W. L. Gore) was adapted to this area in an attempt to induce bone regeneration. The membrane was removed after 6 weeks, at which time a soft regeneration–type tissue was noted. Subsequent examination revealed a persistent 6 mm probing depth on the facial surface of the implant. While the implant has remained stable, the adjacent soft tissues have shown a tendency for recession, which will be monitored in the future.

Case #4. A 58-year-old female had lost both maxillary first premolars as a result of endodontic complications and subsequently underwent implant replacement for these teeth. A single Brånemark implant was placed in each of the 2 sites. Each

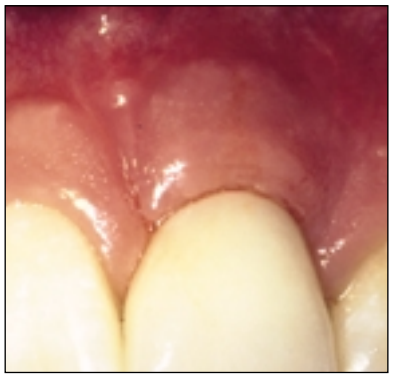

Fig 2a Maxillary central incisor with buccal swelling of gingival tissues around implant crown.

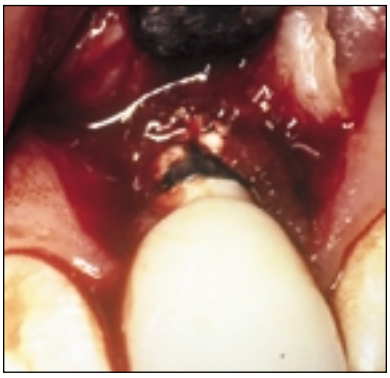

Fig 2b Small amount of excess cement at implant-abutment interface.

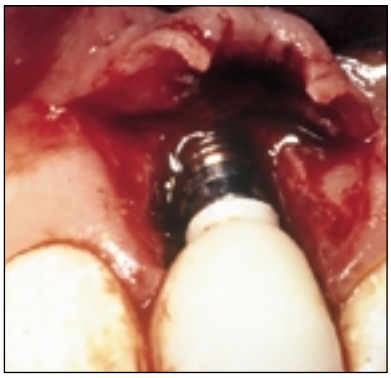

Fig 2c Excess cement was removed and the area debrided.

implant measured 3.75 × 13 mm. Integration time was 7 months; following this, a CeraOne abutment was placed on each implant. The patient then proceeded with restoration of each of the areas with a single metal-ceramic crown, cemented on the abutment. Three years after cementation, the left first premolar crown became loose and was recemented by an associate of the dentist who had first placed the crowns. Some difficulty was experienced in fully seating the crown, and the patient subsequently presented with soreness and swelling of the peri-implant soft tissues. Flap exposure revealed an excess of zinc phosphate cement at the abutment-crown interface. The excess cement was removed and the flaps were replaced. Healing was uneventful. Three weeks after this surgery, the crown again became loose; it was recemented without any further complications.

Discussion

This paper reviewed 4 patients with complications associated with cemented restorations on osseointegrated implants. In all instances, the following complications of rapid onset were observed: peri-implant inflammation associated with swelling, soreness, deeper probing depths, bleeding and/or exudation on probing, and radiographic loss of peri-implant bone. Consideration must be given to the fundamental concepts of prosthodontics and restorative dentistry, which are so important in the success or failure of any cemented restoration and similarly should not be overlooked in implant therapy. In the natural dentition, subgingival cement roughness enhances plaque accumulation in the gingival sulcus,[5] and overhanging margins of restorations change the microflora to one that is consistent with chronic periodontitis, with an increase in gram-negative anaerobic bacteria.[6] A recent study found that plaque deposition is heavier and occurs faster around titanium implants than around natural teeth.[7] Adaptation of the restoration and its contours and the presence of excellent margins will likely affect the outcome of fixed restorations and the future health of the peri-implant tissues.

Screw-retained crowns may also present problems with peri-implant tissues. The loosening of retaining screws and abutment screws can lead to accumulation of granulation tissue between the implant and the abutment, resulting in fistulae, plaque deposition between the prosthesis and the abutment, and fractures of gold or abutment screws.[8] It has been recommended that abutment screws be re-tightened every 5 years.[8] In addition, screw heads with internal hexagons are generally preferred to those with slots, because they usually remain tighter.[8]

If cemented implant crowns are chosen, selection of a luting agent that is easy to manipulate and remove without damaging implant components is important. In each of the patients presented, the implant crown was placed in an esthetically sensitive area, where standard practice involves placement of the crown margin subgingivally. Deep subgingival margin placement is likely to make it difficult to ensure removal of all cement from the margins or to assess damage to the surface of the restoration caused by the removal of the excess cement.[9] Agar et al[10] compared the use of 3 commonly used cement materials (glass-ionomer, resin, and zinc phosphate) for

their ease of removal of excess and for the damage caused to the titanium abutments by various instruments used to remove excess cement. Zinc phosphate cement was found to be the easiest to remove and the resins the most difficult. A stainless steel explorer left the deepest scratches on the abutment surfaces, while plastic scalers caused the least damage. As shown previously by Dmytryk et al,[11] a rough implant surface will lead to increased plaque accumulation, impaired plaque removal, and compromised soft tissue compatibility.

Modifications of techniques or components may reduce the risk of either extrusion of excess cement at crown margins or an inability to detect and remove such excesses. For example, guidelines for cementation of crowns over implants should stress the use of a minimal cement lute, with complete seating of the crown and removal of any excess cement at the time of crown placement. Sharifi et al[12] designed a technique whereby an occlusal access channel is created by waxing around an implant impression coping guide pin luted to the abutment replica. This channel is then filled with gutta-percha and posterior composite at cementation, allowing future crown removal with direct access to the abutment screw. Metal-ceramic crowns also enable the inclusion of a lingual vent hole to allow excess cement to escape to an area where it is easily removed. However, the placement of a vent hole in an all-ceramic crown carries the risk of inducing fracture lines in the ceramic material. Another alternative described in the literature is the use of temporary cement, such as IRM (zinc oxide eugenol, LD Caulk, Dentsply International, Milford, DE), which shows less cement washout and is more retentive than Temp-Bond (Kerr, Orange, CA).[1] However, the increased retention could become a problem if the restoration requires removal. It should also be noted that, regardless of the type of cement used, crowns short of complete seating may be difficult to remove. Therefore, margin seating should be verified radiographically. In terms of components, the use of ceramic abutments may allow placement of crown margins in more accessible areas. Even with the foregoing alternatives, it is important that all dentists become familiar with implant procedures so as to avoid the pitfalls that present in unfamiliar situations. While the cases presented did not result in loss of integration of any of the implants, it remains to be seen whether any long-term effects will be noted.

The importance of postoperative appointments for implant patients following cementation of the restoration cannot be overemphasized. Ideally, the first postoperative visit should be scheduled no later than 1 week after cementation of the restoration to detect early changes or reactions of the peri-implant tissues. These early changes include clinical signs of inflammation, bleeding on probing, and presence of exudation. The patient's concerns and related symptoms are also important, as they may prompt clinical evaluation. Following the first postoperative visit, the patient should be seen at 1-, 3-, and 6-month intervals following placement of the restoration, or sooner if there are concerns. Should peri-implant complications suggest the possibility of residual excess cement, treatment would include conservative exploratory surgery to confirm initial diagnosis and evaluate the extent of the problems, removal of the excess cement, local curettage, regenerative therapies, and replacement of the existing restoration if indicated to restore the health of the surrounding tissues.

References

1. Avivi-Arber L, Zarb GA. Clinical effectiveness of implant-supported single-tooth replacement: The Toronto study. Int J Oral Maxillofac Implants 1996;11:311–321.
2. Jemt T, Lekholm Y, Gröndahl K. A 3-year follow-up study of early single implant restorations ad modum Brånemark. Int J Periodontics Restorative Dent 1990;10:341–349.
3. Ekfeldt A, Carlsson GHE, Borjesson G. Clinical evaluation of single-tooth restorations supported by osseointegrated implants: A retrospective study. Int J Oral Maxillofac Implants 1994;9:179–183.
4. Jorneus L, Jemt T, Carlsson L. Loads and designs of screw joints for single crowns supported by osseointegrated fixtures. Int J Oral Maxillofac Implants 1992;7:353–359.
5. Waerhaug J. The effects of rough surfaces upon gingival tissues. J Dent Res 1956;35:323.
6. Lang NP, Kiel RA, Anderhalden K. Clinical and microbiological effects of subgingival restorations with overhanging or clinically perfect margins. J Clin Periodontol 1983;10: 563–578.
7. Felo A, Shibly O, Ciancio SG, Laurello FR. Effects of subgingival chlorexidine irrigation on periimplant maintenance. J Am Dent Assoc 1997;10:107–110.
8. Kallus T, Bessing C. Loose gold screws frequently occur in full-arch fixed prostheses supported by osseointegrated implants after 5 years. Int J Oral Maxillofac Implants 1994;9:169–178.
9. Christensen GJ. Marginal fit of gold inlay castings. J Prosthet Dent 1966;16:297–305.
10. Agar JR, Cameron SM, Hughbanks JC, Parker MH. Cement removal from restorations luted to titanium abutments with simulated subgingival margins. J Prosthet Dent 1997;78(1):43–47.
11. Dmytryk JJ, Fox SC, Moriarty JD. The effects of scaling titanium implant surfaces with metal and plastic instruments on cell attachment. J Periodontol 1990;61:491–496.
12. Sharifi N, Iok-Chao P, Chai J. Alternative restorative techniques of the CeraOne single-tooth abutment. A technical note. Int J Oral Maxillofac Implants 1994;9:235–238.