design is associated with the problem of generation of internal stresses, which could lead to unexpected fracture of the zirconia implant abutment.

This article will evaluate the fracture causes of several broken zirconia implant abutments. Fractographic analysis of the broken segments will allow recognition of the location and site of the critical fracture.

Case presentations: Case 1

A broken zirconia implant abutment was sent by the treating dentist for fracture analysis. Patient’s records indicated that the patient complained of loosening of the implant-supported zirconia-veneered crown (#21).

The treating dentist also complained that the internal metallic nut had lost friction contact with the zirconia abutment and that he had to re-assemble the components before screw fixation. The abutment was fractured after two incidents of screw loosening. The same problem led to fracture of the second abutment, after which the dentist decided to insert a titanium abutment. Scanning electron microscopic examination indicated that the abutment was fractured due to pressure from the metallic screw nut.

The solution

Once the metallic nut has lost friction contact with the zirconia abutment and that he had to re-assemble the components before screw fixation, the abutment was fractured after two incidents of screw loosening. The same problem led to fracture of the second abutment, after which the dentist decided to insert a titanium abutment. The solution

Case 2

This next case featured a broken zirconia implant abutment. SEM analysis revealed that it was an angled abutment, which corrected the tilt of an implant replacing a maxillary lateral incisor. The entire buccal wall was fractured beneath the temporarily cemented zirconia-veneered crown.

The solution

Zirconia is a brittle ceramic material that must be used in adequate thickness to gain full potential of its high strength. A minimal wall thickness (0.5-0.7 mm) is required in the entire structure of the zirconia implant abutment.

This thickness must be increased in areas of high stresses to avoid unexpected fracture. Tilt correction resulted in over-reduction of the buccal wall (0.3 mm thickness), which resulted in fracture of the weakened segment.

To reduce possibility of fracture, it is recommended to use a metallic abutment for correction of angle of insertion.

Case 3

The final case featured a broken veneer porcelain from a Procera zirconia superstructure. This new design combines both the implant abutment and the framework of the restoration in one single structure, thus reducing the number of components the dentist uses during the prosthetic phase.

This single component zirconia structure does not utilize an internal metallic nut for achieving contact with the implant body.

On the contrary, this single component super structure utilizes the fixation screw to obtain direct fixation to the implant body.

The solution

Using single component superstructures has several advantages as they simplify the handling procedure, do not require anti-rotation feature and reduce the number of structural interfaces of the entire restoration. On the other hand, they require careful design to provide adequate support for the veneer ceramic.