Discussion

All IH implants used in this study showed fractures in the fixation screw, while the IC implants showed no fractures. Both systems employed different mechanical principles of function.[5] In the IH configuration, the axial preload of the abutment screw was a primary factor for stability of the connection and the screw alone secured the abutment. There was no form lock or positive locking by the internal hex, which did not absorb any lateral loading.[5] Therefore, when oblique forces were applied to the implant-abutment assemblies during the tests, the yield point of the assemblies was basically the yield point of the screws. In IC connections, form lock and friction were the primary principles. Lateral loading was mainly resisted by the tapered interface, which prevented fractures of the abutments.

Normal chewing forces have been reported in the literature, ranging between 30 and 50 kgf in posterior regions. For all specimens tested, plastic deformations started to occur under oblique compressive loads of over 80 kgf. Thus, both systems presented an adequate resistance, which indicates that under normal occlusal conditions, both would present a successful clinical performance.

MDF can be used as a parameter value of the oblique load each system is capable of resisting before destructive events occur. Although MDF values were statistically different between the systems, these differences were not high enough to be considered clinically significant. If these systems were subjected to excessive oblique compressive forces surpassing their MDFs, screw fractures would probably occur in the IH abutments, while permanent deformations would be more likely to happen on the neck of the IC abutments. Either way, both systems would possibly show permanent deformations on the implant platform, resulting in failure of the treatment. These findings reinforce the importance of careful planning and refined occlusal adjustments, avoiding excessive oblique loads. Further studies are necessary to compare the fatigue resistance of both systems under dynamic cyclic loading in order to provide more accurate data concerning their long-term fracture resistance.

Conclusion

Under the conditions of this in vitro investigation, the results indicate that the friction-locking mechanics and solid design of the one-piece abutments of the IC connection system provided greater deformation and fracture resistance to the implant-abutment assembly under oblique compressive loading when compared to the IH connection system. Further in vitro and clinical investigations are needed to evaluate the fatigue resistance of these systems under long-term dynamic cyclic loading.

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References

1. Maeda Y, Satoh T, Sogo M. In vitro differences of stress concentrations for internal and external hex implant-abutment connections: A short communication. J Oral Rehabil 2006;33:75–78.
2. Bozkaya D, Müftü S. Mechanics of the taper integrated screwed-in (TIS) abutments used in dental implants. J Biomech 2005;38:87–97.
3. Norton MR. An in vitro evaluation of the strength of a 1-piece and 2-piece conical abutment joint in implant design. Clin Oral Implants Res 2000;11:458–464.
4. Khraisat A, Stegaroiu R, Nomura S, Miyakawa O. Fatigue resistance of two implant/abutment joint designs. J Prosthet Dent 2002;88:604–610.
5. Merz BR, Hunenbart S, Belser UC. Mechanics of the implant-abutment connection: An 8-degree taper compared to a butt joint connection. Int J Oral Maxillofac Implants 2000;15:519–526.

Erratum

In IJP issue 2, 2009, in the article by Zitzmann et al, Figure 2g should appear as follows. The online version of this paper has been corrected. The publisher regrets this error.