AHMAD MANAWAR[1], B. DHANASEKAR[2], I. N. APARNA[3], HINA NAIM[4]

[1] Assistant professor, Manipal College of Dental Sciences, Manipal (Karnataka), India
[2] Professor, Manipal College of Dental Sciences, Manipal (Karnataka), India
[3] Professor and Head, Manipal College of Dental Sciences, Manipal (Karnataka), India
[4] Melaka Manipal Medical College, Faculty of Dentistry, Manipal (Karnataka), India

Factors influencing success of cement versus screw-retained implant restorations: a clinical review

TO CITE THIS ARTICLE
Manawar A, Dhanasekar B, Aparna I.N, Naim H. Factors influencing success of cement versus screw-retained implant restorations: a clinical review. J Osseointegr 2012;3(4):43-47.

ABSTRACT

Aim As more and more dental practitioners are focusing on implant-supported fixed restorations, some clinicians favor the use of cement retained restorations while others consider screw retained prosthesis to be the best choice.

Discussion In screw-retained restorations, the fastening screw provides a solid joint between the restoration and the implant abutment, while in cement-retained prostheses the restorative screw is eliminated to enhance esthetics, occlusal stability, and passive fit of the restorations. The factors that influence the type of fixation of the prostheses to the implants like passivity of the framework, ease of fabrication, occlusion, esthetics, accessibility, retention and retrievability are discussed in this article with scientific studies demonstrating superior outcomes of one technique over another. Screw-retained implant restorations have an advantage of predictable retention, retrievability and lack of potentially retained subgingival cement. However, a few disadvantages exist such as precise placement of the implant for optimal and esthetic location of the screw access hole and obtaining passive fit. On the other hand, cement retained restorations eliminate unesthetic screw access holes, have passive fit of castings, reduced complexity of clinical and lab procedures, enhanced esthetics, reduced cost factors and non disrupted morphology of the occlusal table.

Conclusion This article compares the advantages, potential disadvantages and limitations of screw and cement retained restorations and their specific implications in the most common clinical situation.

KEY WORDS Cement-retained implant prosthesis; Screw-retained implant prosthesis.

INTRODUCTION

Implant dentistry has seen rapid and remarkable progress in recent years. The quest for predictable long-term results has raised several questions concerning the techniques followed in clinical practice. One of these questions is the connection between the restoration and the implant (1, 2). Implant restorations can be screw-retained or cement retained. In screw-retained restorations, the fastening screw provides a solid joint between the restoration and the implant abutment, while in cement-retained prostheses the restorative screw is eliminated to enhance esthetics, occlusal stability, and passive fit of the restorations.

The factors that influence the type of fixation of the prostheses to the implants are as follows.

1) Passivity of the framework.
2) Ease of fabrication and cost.
3) Occlusion.
4) Complications.
5) Esthetics.
6) Accessibility.
7) Retention.
8) Retrievability.
9) Cementation.

Passivity of framework

The clinical longevity of implant supported bridge depends, to a greater extent, on the precision fit of the framework. Non passive fitting of the implant supported superstructures can cause high incidence of technical complications. Distortion of the impression material, setting expansion of the dental stone, wax pattern and metal casting shrinkage are all contributing factors to the non-passive fitting of the framework (3, 4). There can be two possible complications of non-passive fitting of the frameworks:

A. Biological complications: Increased transfer of load to the bone, bone loss, and development of microflora at the gap between the implant and the abutment.
B. Prosthetic complications: Loosening or fracture of

the fastening screw.

A passive fit is easier to accomplish in cement retained restorations. They have the potential to compensate for any minor dimensional discrepancies in the fit of restorations to abutments, which can contribute to lack of passivity. Minor dimensional discrepancies may be compensated by using cement thanks to cement space. The die spacer creates an approximately 40 µm cement space, which compensates for laboratory distortions and permits a more passive casting (5-7).

Fulcrums or pivot points are created at the edge where the abutment meets the head of the implant (Fig. 1). The torque that is applied to tighten the screw in screw retained implant prosthesis is converted into tensile force (preload Fs x r). The upsetting masticatory Occlusal force (Fo), can be resolved into its component vertical (Fv) and horizontal forces (Fh). To maintain equilibrium, the resisting moment of the screw (Fs x r) must be greater than or equal to the sum of the moments created by the offset loading (F v x L2 + F h x L1) (Fig. 1).

If there is an accurate fit between the head of the implant and abutment, a continuum of pivot points is created around the circumference. In this stable situation, vertical occlusal force will not stress the screw or cause screw loosening. However when inaccurate castings are screwed into implants, gaps are created and vertical loading over the implant head can compress the casting and cause screw loosening. In this situation, load is applied outside the pivot point (offset loading) and in that way as a sufficient magnitude to overcome the clamping force of the screw (8-10).

Ease of fabrication and cost

The fabrication of cement-retained prostheses is much easier than screw-retained prostheses because of fewer components and lower laboratory charges. As manufacturers do not provide pre-angled abutments for screw-type restorations with divergence of the screw path of less than 17°, restoration of implants is easier with cement retained prostheses in such clinical situations. Provisional crowns are far easier to fabricate with cement retained prosthesis than screw-retained ones.

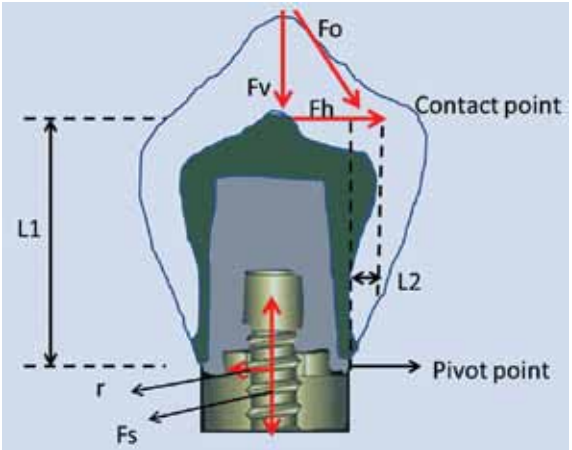

FIG. 1 Diagram illustrating the mechanism of screw retained prosthesis; Tensile force on screw (Fs x r) must be > (F v x L2 + F h x L1).

Occlusion

With cement-retained prostheses, ideal occlusal contacts can be established and remain stable over a long period of time (11). Ideally, an implant should be placed in the central fossa in order to generate an axial loading to be generated in the case of posterior teeth. The establishment of ideal occlusal contacts in screw retained prostheses may not be possible, because the screw access hole occupies significantly 50% of the occlusal table of the molars and more than 50% of the occlusal table of the premolars. Composite material used to cover the screw holes wears, especially when the opposing restorative material is porcelain. However, this occlusal discrepancy can be overcome with the use of TS (Transversal) screw; but it is necessary to have good oral access to the TS screw that fixes the prosthesis to the abutment, usually in the palatal or lingual area (12).

Complications

Implant restorations receive cyclical loading due to the nature of chewing and, consequently, screw-retained restorations experience screw loosening and fatigue fractures of their prosthetic screws. Frequency of screw loosening is reported to be between 10% and 65% mainly in posterior areas. Thus screw-retained restorations are associated with more complications than cement-retained ones. Porcelain fracture is more prevalent due to unsupported material around the screw access hole (13-15).

Esthetics

In screw-retained restorations, the implants are placed palatally in the anterior region of the maxilla to allow screw emergence through the cingulum area. Palatal implant placement results in a porcelain ridge lap, which compromises hygiene. Also restoration is cantilevered facially from the implant body, which results in offset loading of the implant. In posterior region, the access hole exits through the central fossa of the prosthetic tooth. This is not only a cosmetic compromise but also an occlusal one.

The esthetic outcome of cement retained prosthesis is more favorable than screw retained prosthesis (12).

Accessibility

Restoring a screw retained prosthesis in a patient with a limited opening and/or in the posterior region of the mouth can be challenging. The implant-abutment connection must line up with the interproximal contacts to allow seating of the one-piece restoration. A cement-retained crown may be easier to deliver in these situations (Fig. 2).

FIG. 2 Cement retained prosthesis in posterior mandible

Retention

The factors that influence retention of implant supported restorations are the same as those for natural teeth: taper, surface area and height, surface roughness and type of cement (16-18).

a) Taper: in clinical situations where implants are not parallel to each other, they may require further preparation and tapering of their abutments to enable an ideal path of insertion for the bridge prosthesis. Overtapered abutments may lack adequate retention for the cement retained bridge prosthesis and require a screw-retained prosthesis.
b) Surface area and height: at least 5 mm of abutment height is needed for proper retention and resistance of cement-retained crowns. Therefore, screw-retained crowns are required in situations when limited inter-arch space dictates an abutment that would be shorter than 5 mm. Another advantage of a screw-retained superstructure is retention of the low-profile abutments for bar-retained overdentures. The lower height of the screw-retained bar offers greater room for denture teeth and greater thickness of acrylic.
c) Surface roughness: implant abutments can be roughened with either a diamond bur or with airborne particles if more retention is required. However, the 6° taper and the long axial walls of the abutment usually make more retention unnecessary.
d) Cement: the intervening cement layer used in cement retained restoration acts as a shock absorber and enhance the transfer of load throughout the prosthesis-implant-bone system. For screw-retained restorations, retention is obtained by the friction resistance developed between the internal threads of the implant and those of the fastening screw. In the case of titanium abutment screws, there can be slight damage of both the implant and the fastening screw threads, which results in their joining. This phenomenon is called galling (19-20).

Retrievability

The main advantage of screw-retained prostheses is their retrievability. A screw-retained crown is not only recoverable, but also no damage occurs upon removal of the crown itself (Fig. 3). Cleaning, screw replacement and assessment of surrounding tissue is easily possible. On the other hand, the main disadvantage of cement retained prostheses is the difficult retrievability. When an abutment loosens or any repair of the restoration become necessary, the restoration may be destroyed during the removal procedure if the cement seal cannot be easily broken. Any force applied to a restoration on a loosened abutment has the potential to damage the internal threads of the implant (21-24).

FIG. 3 Screw-retained prosthesis after retrieval from the mouth.

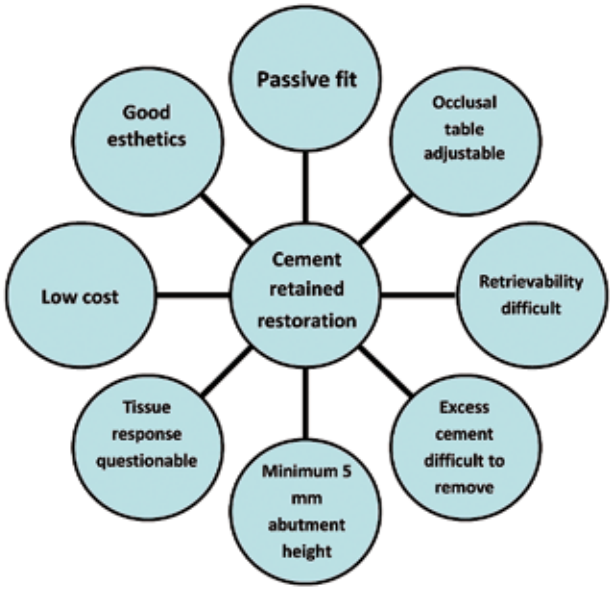

FIG. 4 Advantages and disadvantages of cement-retained prostheses.

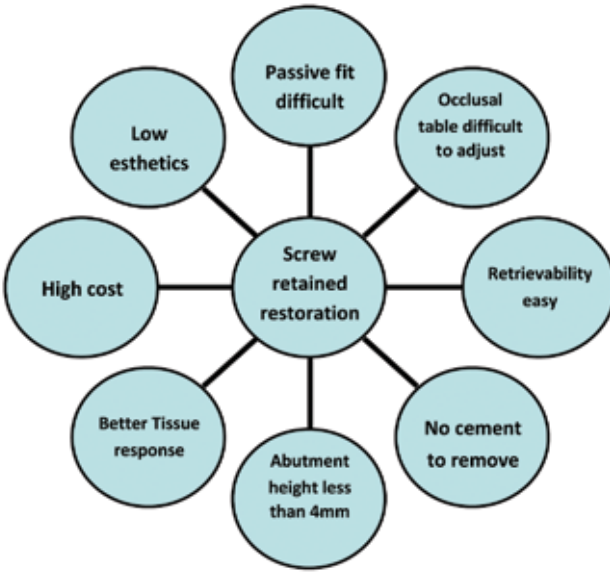

FIG. 5 Advantages and disadvantages of screw-retained prostheses.

Cementation of prosthesis

Removal of cement residues is critical for peri-implant health in cement retained prosthesis and can cause peri-implant inflammation associated with bleeding and/or exudation and peri-implant bone loss. Removal of excess cement is difficult especially when the margins of the restoration are subgingival. To reduce the risk for cement trapping, it is essential to position the height of the crown-abutment interface at, or slightly below the gingival margin to allow easy access and complete removal of luting agents. For screw-retained restorations, only a radiographic examination is required to verify the precise fit of the prostheses to the implants before proceeding to the final torqueing of the fastening screws (25-28).

CONCLUSION

The decision to use cement or screw to retain an implant supported restoration depends on the personal preference of the clinician and patient specific clinical situation. Screw-retained implant restorations have an advantage of predictable retention, retrievability and lack of potentially retained sub-gingival cement. However, a few disadvantages exist, such as precise placement of the implant for optimal and esthetic location of the screw access hole and obtaining passive fit. On the other hand, cement retained restorations eliminate unaesthetic screw access holes; have passive fit of castings; reduced complexity of clinical and lab procedures; enhanced esthetics; reduced cost factors and non disrupted morphology of the occlusal table. Also it has the potential to reduce stress to splinted implants because the effects of minor misfit of the framework are not transferred directly to the implants, as in the case of screw-retained prosthesis (Fig. 4, 5). However, excess cement extruding from the prosthesis/abutment interface, especially when located sub-gingivally, can cause inflammation, infection and periodontal complications. Also there is potential difficulty in retrieving the restoration.

REFERENCES

1. Michalakis KX, Hirayama H, Garefis PD. Cement-retained versus screw retained implant restorations: a clinical review. Int J Oral Maxillofac Implants 2003; 8(5):719-28.
2. Uludag B, Celik G. Fabrication of cement and screw retained multiunit implant restoration. J Oral Implantol 2006;32(5):248-50.
3. Lee J, Kim YS, Kim CW, Han JS. Wave analysis of implant screw loosening using an air cylindrical cyclic loading device. J Prosthet Dent 2002;88(4):402-8.
4. Hecker DM, Eckert SE. Cyclic loading of implant-supported prostheses: changes in component fit over time. J Prosthet Dent 2003;89(4):346-51.
5. Chee W, Felton DA, Johnson PF, Sullivan DY. Cemented versus screw-retained implant prostheses: which is better? Int J Oral Maxillofac Implants 1999;14(1):137-41.
6. Misch CE. Principles of Cement Retained Fixed Implant Prosthodontics. Contemporary Implant Dentistry. 2nd ed. St Louis, Mo: Mosby; 1998. p.549-573.
7. Taylor TD, Agar JR. Twenty years of progress in implant prosthodontics. J Prosthet Dent 2002;88(1): 89-95.
8. Guichet DL. Load transfer in screw- and cement-retained implant fixed partial denture design. J Prosthet Dent 1994; 72:631.
9. Guichet DL, Caputo AA, Choi H, Sorensen JA. Passivity of fit and marginal opening in screw- or cement-retained implant fixed partial denture designs. Int J Oral Maxillofac Implants 2000;15(2):239-46.
10. Nissan J, Gross M, Shifman A, Assif D. Stress levels for well-fitting implant superstructures as a function of tightening force levels, tightening

sequence, and different operators. J Prosthet Dent 2001;86(1):20-3.
11. Eskitascioglu G, Usumez A, Sevimay M, Soykan E, Unsal E. The influence of occlusal loading location on stresses transferred to implant-supported prostheses and supporting bone: A three-dimensional finite element study. J Prosthet Dent 2004;91(2):144-50.
12. Hebel KS, Gajjar RC. Cement retained versus screw-retained implant restorations: achieving optimal occlusion and esthetics in implant dentistry. J Prosthet Dent 1997;77(1):28-35.
13. Assenza B, Scarano A, Leghissa G, Carusi G, Thams U, Roman FS, Piattelli A. Screw- vs cement-implant-retained restorations: an experimental study in the Beagle. Part 1. Screw and abutment loosening. J Oral Implantol 2005;31(5):242-6.
14. Goodacre CJ, Bernal G, Rungcharassaeng K, Kan JY. Clinical complications with implants and implant prostheses. J Prosthet Dent 2003;90(2):121-32.
15. Schwarz MS. Mechanical complications of dental implants. Clin Oral Implants Res 2000;11 Suppl 1:156-8.
16. Jorgensen KD. The relationship between retention and convergence angle in cemented veneer crowns. Acta Odontol Scand 1955;13(1):35-40.
17. Shillingburg HT, Hobo S, Whitsett LD. Principles of Preparations. Fundamentals of Fixed Prosthodontics. 2nd ed. Chicago: Quintessence Pub. 1981:79–96.
18. Kaufman EG, Coelho DH, Collin L. Factors influencing the retention of cemented gold castings. J Prosthet Dent 1961; 11: 487-98.
19. Michalakis KX, Pissiotis AL, Hirayama H. Cement failure loads of 4 provisional luting agents used for the cementation of implant-supported fixed partial dentures. Int J Oral Maxillofac Implants 2000;15(4):545-9.
20. Squier RS, Agar JR, Duncan JP, Taylor TD. Retentiveness of dental cements used with metallic implant components. Int J Oral Maxillofac Implants 2001;16(6):793-8.
21. Rajan M, Gunaseelan R. Fabrication of a cement- and screw-retained implant prosthesis. J Prosthet Dent 2004;92(6):578-80.
22. Valbao FP Jr, Perez EG, Breda M. Alternative method for retention and removal of cement-retained implant prosthesis. J Prosthet Dent 2001;86(2):181-3.
23. Doerr J. Simplified technique for retrieving implant restorations. J Prosthet Dent 2002;88(3):352-3.
24. Okamoto M, Minagi S. Technique for removing a cemented superstructure from an implant abutment. J Prosthet Dent 2002;87(2):241-2.
25. Dumbrigue HB, Abanomi AA, Cheng LL. Techniques to minimize excess luting agent in cement-retained implant restorations. J Prosthet Dent 2002;87(1):112-4.
26. Pauletto N, Lahiffe BJ, Walton JN. Complications associated with excess cement around crowns on osseointegrated implants: a clinical report. Int J Oral Maxillofac Implants 1999; 14(6):865-8.
27. Breeding LC, Dixon DL, Bogacki MT, Tietge JD. Use of luting agents with an implant system: Part I. J Prosthet Dent 1992;68(5):737-41.
28. Weber HP, Kim DM, Ng MW, Hwang JW, Fiorellini JP. Peri-implant soft-tissue health surrounding cement- and screw-retained implant restorations: a multi-center, 3-year prospective study. Clin Oral Implants Res 2006;17(4):375-9.