

Adjacent Dental Implants Classification Based on Restorative Design

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There is controversy in the literature regarding the indicated retentive mechanism for implant-supported crowns. When adjacent implants are restored, the restoration can be screw retained, cement retained, or a combination of cement and screw retained. Adjacent implant-supported crowns can be restored as individual implant supported crowns or can be splinted. A classification system is proposed when adjacent implants are restored. The classification system describes currently available options to restore adjacent implants. Six types of prosthetic design options are proposed as Class I through Class VI. In Class I design, individual cement-retained crowns are made. In Class II, individual screw-retained crowns are fabricated. Class III involves fabrication of individual screw-retrievable/cement-retained crowns. Class IV prosthetic design involves splinted cement-retained implant crowns. Class V prosthetic design involves splinted screw-retained crowns, and Class VI involves splinted screw-retrievable/cement-retained implant supported crowns.

Key Words: combination prosthesis, screw retained prosthesis, cement retained prosthesis, screw and cement retained prosthesis, passive fit, adjacent implants, classification, code, dental implant design, adjacent implants

INTRODUCTION

While dental implants were introduced for completely edentulous patients,¹ they soon became a valid treatment modality for partially edentulous patients as well.^{2,3} Among other factors, the distribution of occlusal forces may influence the long-term success of dental implants.⁴⁻⁸ Several authors have suggested that splinting adjacent implants may reduce the occlusal forces that are applied to each individual implant.⁹⁻¹¹ A study based on finite element analysis concluded that occlusal forces are better distributed when adjacent implants are splinted together.¹² On the other hand, restoring adjacent implants with individual crowns enhances esthetics and eliminates the issue of addressing potential lack of passive fit of a splinted prosthesis.^{13,14} Vigolo et al⁴ reported that after 10 years of functional loading, marginal bone loss around nonsplinted implants was comparable to marginal bone loss around splinted implants. However, splinted implant prostheses have been associated with increased veneer and framework fracture.¹⁴ It is typically easier to address prosthetic complications in nonsplinted adjacent implants because if 1 unit has a prosthetic complication then only that unit needs to be

removed; whereas if the crowns are splinted, the clinician would have to remove the entire prosthesis. When adjacent implants are nonsplinted, oral hygiene is easily facilitated, and less stress may be applied onto the implants through the prosthesis.¹⁵

Screw-retentive prosthesis have the advantage of being easily retrievable.^{16,17} However, the presence of occlusal access holes compromises the esthetics, ceramic strength, and occlusion.^{16,18} Cement-retained prostheses are easier to fabricate, offer easier access to the posterior area of the mouth, and have higher potential for passive fit.¹⁶⁻²⁰ While an earlier systematic review focusing on implant and prosthesis survival rate indicated no differences between cement-retained and screw-retained prostheses,²¹ a more recent systematic review revealed significantly more biologic complications with cement-retained prostheses while screw-retained prostheses demonstrated increased technical complications.²² Similar findings were published by Wittneben et al²³ and Millen et al,²⁴ where screw-retained restorations were associated with increased rate of technical complications. Finite element analysis²⁵ and clinical²⁶ studies have indicated similar results when screw-retentive prostheses were associated with increased risk of mechanical complications.

A major limitation of cement-retained implant restoration is the difficulty to remove the excess cement.^{27,28} Residual cement remnants have been associated with peri-implantitis.²⁹⁻³⁴ To address this, some authors³⁵⁻³⁸ recently introduced a new design of screw-retrievable and cement-retained implant-supported prostheses featuring the combined advantages of both modes of retention. In a clinical study, Nissan et al³⁹ reported that the combination of cement and screw-retained implant prostheses improves the survival rates of the prosthesis over

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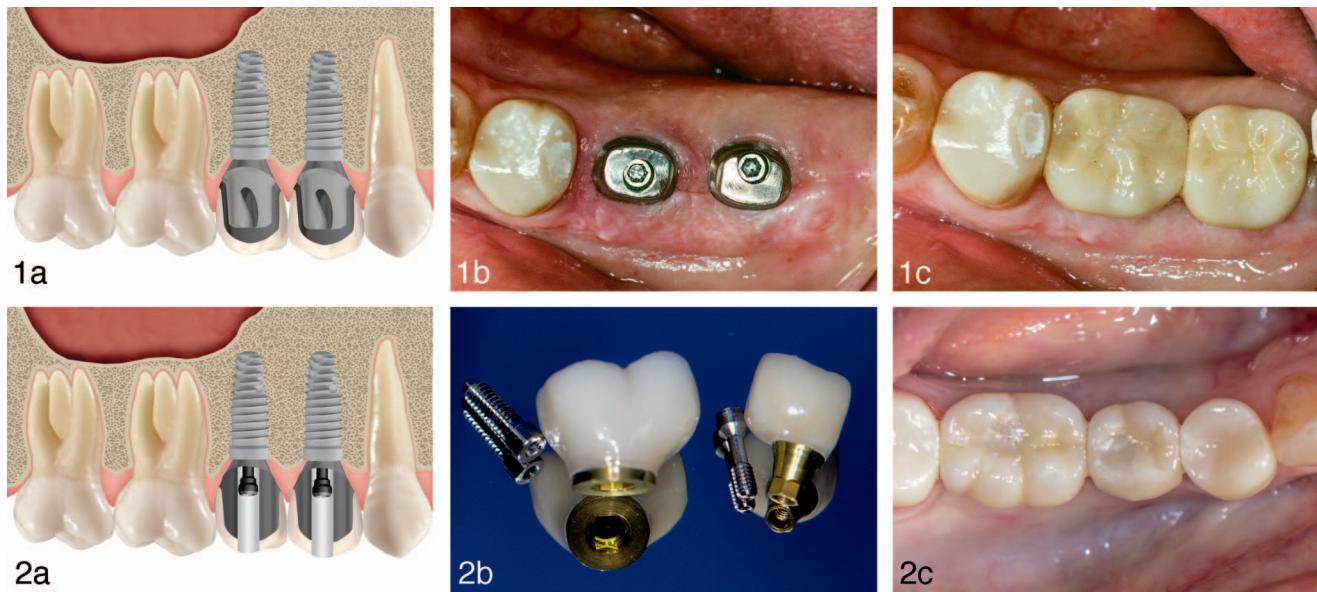
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FIGURES 1 AND 2. **FIGURE 1.** (a) Class I prosthetic design. Individual crowns are fabricated and cemented on the abutments. (b) Clinical situation where individual abutments were placed on adjacent implants. (c) Clinical situation where the definitive prosthesis was placed on adjacent implants comprising individual crowns cemented on the abutments. **FIGURE 2.** (a) Class II prosthetic design. Individual crowns are made that are screw retained on the implants. (b) Clinical situation where 2 adjacent individual screw-retained crowns were fabricated. (c) Definitive screw-retained crowns.

time and lowers the cost of maintenance without increasing the risk for porcelain fracture or screw loosening.

The purpose of the current article is to introduce a classification system when 2 adjacent implants are being restored. The aim of the proposed classification system is to incorporate and identify all the different design choices regarding splinting adjacent implants or restoring them as individual units, and using a screw, cement, or a combination

of both retentive mechanisms for the definitive implant prosthesis.

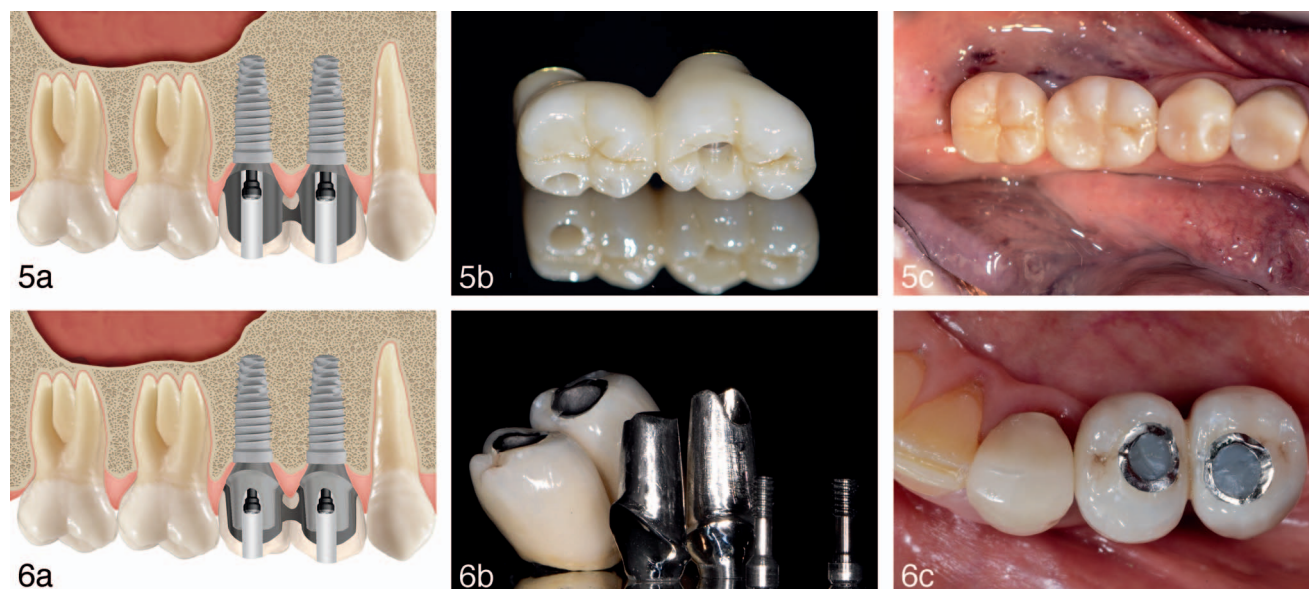
Classification

Following are the different classifications of prostheses:

- Class I prosthetic design: Individual crowns are cemented on the abutments (Figure 1).



FIGURES 3 AND 4. **FIGURE 3.** (a) Class III prosthetic design. Individual crowns are fabricated that are cement and screw retained. (b) Clinical situation where 2 adjacent implants were restored with 2 individual cement- and screw-retained crowns. **FIGURE 4.** (a) Class IV prosthetic design. The crowns are splinted together and cemented on the abutments. (b) Prosthetic design where 2 splinted crowns were fabricated to be cemented on the abutments. (c) Clinical situation; intraoral view with the definitive Type IV prosthesis cemented on the abutments.



FIGURES 5 AND 6. FIGURE 5. (a) Class V prosthetic design. The crowns are splinted and screw retained on the implants. (b) Clinical example where 2 splinted screw-retained crowns were fabricated to restore 2 adjacent implants. (c) Intraoral view, Type V prosthetic design. **FIGURE 6.** (a) Class VI prosthetic design. The crowns are splinted together and are designed to be cement- and screw-retained on the abutments. (b) Example of Type VI prosthesis, splinted crowns designed to be cement- and screw-retained on the abutments. (c) Type VI prosthesis; the splinted crowns are designed to be intraorally cemented and then screw retained to be easily retrievable.

- Class II prosthetic design: Individual crowns are screw retained on the implants (Figure 2).
- Class III prosthetic design: Individual screw-retrievable cement-retained prostheses are made (Figure 3).
- Class IV prosthetic design: Splinted crowns are cemented on the abutments (Figure 4).
- Class V prosthetic design: Splinted crowns are screw retained on the implants (Figure 5).
- Class VI prosthetic design: Splinted crowns are designed to be screw retrievable/cement retained on the implants (Figure 6).

DISCUSSION

The significance of the proposed classification is that it offers a way to codify the different design modalities that are available when restoring adjacent implants (Table). The primary advantage of a screw-retention design is the ease of

prosthesis retrievability.^{16,17} Some authors support the need for prosthesis retrievability with the well-established high implant success rates.²¹⁻²⁴ Prosthetic complications can be better addressed when the prosthesis is easily retrievable. On the other hand, cement-retained prosthesis have been documented to offer better esthetics,^{16,17} better occlusion,¹⁶ and superior passive fit compared with a screw-retrievable prosthesis.^{19,20} Superior passive fit is associated with higher reduction of stress on the supporting implants and strain on the prosthesis.^{15,25} Both retentive mechanisms are acceptable so long as the clinician can weigh the advantages and limitations of each retentive mechanism concept when choosing for a specific clinical situation. The suggested screw-retrievable/cement-retained³⁵⁻⁴⁰ implant-supported prosthesis combines the advantages of cement and screw retention mechanisms while offering an additional design consideration.

Although splinting adjacent implants can be advantageous

TABLE 1

Grading the anticipated advantages and limitations of each designed prosthesis for each design classification*

	Class I	Class II	Class III	Class IV	Class V	Class VI
Retrievability	-	++	++	-	+	+
Esthetics	+	-	-	+	--	--
Passive fit	++	++	++	+	--	+
Prosthesis providing support between implants	-	-	-	+	+	+
Difficulty in cement retrieval	+	-	-	++	-	-
Ease of developing occlusion	+	-	-	+	-	-
Accessibility in the posterior area of the mouth	+	-	-	+	-	-
Accessibility for oral hygiene	+	+	+	-	-	-

*Superior outcome (+), inferior outcome (-).

in distributing occlusal forces,^{9–11} several authors have indicated that restoring adjacent implants with individual prosthetic units might be a better treatment modality.^{13,14} Long-term clinical data have demonstrated that there is no superiority in either restorative concept.⁴ Splinting or non-splinting adjacent implants seems to be acceptable, and clinicians need to be familiar with potential advantages and drawbacks of each restorative concept. This article identifies and classifies the different prosthetic options for restoring adjacent implants. The proposed classification codifies the currently available retentive and splinting versus nonsplinting concepts of definitive prosthesis designs for adjacent implants for effective communication and reporting. It is anticipated that this classification can be utilized in future reports of complications associated with these different designs.

CONCLUSION

The proposed classification for restoring adjacent root form implants offers a systematic codification regarding options to provide retention to the implant prostheses and splinting versus non-splinting design considerations. It is anticipated that this classification can assist in compiling outcomes data regarding complications.

NOTE

The authors declare no conflicts of interest.

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ERRATUM

Retraction of: Gharpure AS, Bhatavadekar N. Current evidence on the socket-shield technique: a systematic review. *J Oral Implantol*. In press. DOI: 10.1563/aid-joi-D-16-00174

The article above is hereby retracted by *Journal of Oral Implantology*. After the article was accepted, it was determined that the findings were not scientifically conclusive. The article had been accepted for publication and was published online ahead of print, but had not been published in an issue in its final format.