

Titanium posts and bonded amalgam core longevity

A 22-year clinical survival retrospective study

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Endodontically treated teeth have a shorter survival time than vital teeth,^{1,2} and it has been speculated that remaining tooth structure is the most important factor for maintaining viability.³⁻⁷

Another factor is the type of crown used. There are studies that confirm that when an endodontically treated tooth is restored with a single full-coverage crown with proximal contacts, and without being part of a tooth removal or fixed prosthesis, the tooth has a greater probability of survival.⁸⁻¹⁰ In addition, the tooth's prognosis is influenced by other factors such as occlusal contacts, its location in the dental arch,^{11,12} and ferrules. Ferrules have been defined as the necessary dentin circumferential area with a minimum height of 1.5 to 2 millimeters to obtain an adequate fracture resistance.¹³⁻¹⁷ A ferrule reduces the stress between core restorations and dentin.¹⁸ However, authors have proposed that lost fracture protection that the absence of ferrules may pose can be resolved using adhesive agents.^{19,20}

The function of a post is to support the core restorative material,²¹ but authors have speculated that its placement shortens the life of the tooth because of the removal of root dentin.²² Therefore, a finer post increases the resistance to fracture, as it removes less dentin,²³ and a gutta-percha apical seal of 3 to 6 mm should be maintained.^{24,25} In vitro studies confirm that metal posts are useful to restore endodontically treated teeth,²⁶ although their failure can cause tooth loss due to root fracture.²⁷ The most suitable material for the metal post is titanium, which causes less corrosion and is more biocompatible than magnesium or zinc.²⁸

ABSTRACT

Background. The authors conducted a retrospective study to evaluate the long-term (18-22 years) clinic results of titanium post and bonded amalgam core restorations with metal-ceramic crowns placed in patients.

Methods. From 1992 through 1996, the authors placed 88 restorations in 66 patients. They measured the ferrule effect in the minor dentin collar area. In 2014, the authors analyzed the following variables: ferrule length, length and thickness of the post, and tooth position.

Results. The overall survival of the restorations decreased over time with survival rates of 89.6% after 5 years of follow-up appointments and 64.2% after 18 years of follow-up appointments. There were 42 failures, and the maxillary premolars had the most failures. The teeth with 2 or more millimeters ferrule length had a higher survival rate than those with a 0 to less than 2 mm ferrule length; these results were not statistically significant.

Conclusions. Statistically significant differences were detected according to the location of the tooth. The cores in the anterior teeth were 3.26 times more likely to fail than those in the molars, which presented higher survival rates; maxillary premolars had the most failures (28.5%). Both the metallic post length and its diameter did not influence restoration survival. The ferrule length was not statistically significant.

Practical Implications. The clinical technique to restore endodontically treated teeth that includes a titanium post and bonded amalgam restorations results in greater coronal destruction but shows good long-term results, ease of fabrication, and modest cost in comparison with other techniques.

Key Words. Amalgam core; ferrule; hard copper band; composite resin; survival curve; titanium post.

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TABLE 1

Distribution of the teeth.*				
TOOTH TYPE	INCISORS	CANINES	PREMOLARS	MOLARS
Maxillary	6	12	24	16
Mandibular	-†	6	4	20

* Taken from 66 total participants.
† Dash indicates not applicable.

TABLE 2

Length and thicknesses of posts used.							
VARIABLES	UNIMETRIC 1.0 (1-MM* DIAMETER APEX)			UNIMETRIC 0.8 (0.8-MM DIAMETER APEX)			
	9.5	11.5	13.5	8.25	9.5	11.5	13.5
Length (mm)	9.5	11.5	13.5	8.25	9.5	11.5	13.5
Incisors	1	1	1	–	–	2	1
Canines	-†	4	5	–	–	3	6
Premolars	3	4	1	2	6	7	5
Molars	9	8	2	2	2	9	4

* mm: Millimeters.
† Dashes indicate not applicable.

The objective of this study was the long-term evaluation (18-22 years) of titanium post restorations with a bonded amalgam core and metal-ceramic crown clinic results. The hypothesis was to determine which factors influence the restoration's long-term survival.

METHODS

Our retrospective study included restorations placed from 1992 to 1996 in a private clinic in Santiago de Compostela, Spain, which were re-evaluated in 2014. We included 88 restorations in 66 patients (42 women and 24 men; mean [standard deviation] age 44.47 [18.33] years at the time of treatment).

The clinician (V.A.P.) cemented titanium pre-fabricated posts and bonded amalgam cores before placing metal-ceramic crowns. The same clinician performed all treatments. The Ethics Committee of the University of Santiago de Compostela on Investigations Involving Human Subjects approved the protocol of this study, in full accordance with the World Medical Association Declaration of Helsinki.²⁹ Patients provided written informed consent for inclusion in the study at the time of the evaluation.

Our study participants fulfilled the following inclusion criteria: older than 18 years, full dentition without periodontal disease, no bruxism, teeth without sub-gingival tooth loss (ferrule \geq 0 mm), temporary restorations made without eugenol, and diagnosed using periodontal probe and radiographs.

We established classification criteria for 2 groups according to the ferrule length in dentin collar height: Group 1, ferrule length 0 to less than 2 mm; and Group 2, ferrule length 2 mm or greater. The clinician measured the

ferrule length with a periodontal probe (973 72W Williams, Carl Martin) at the time the restorations were made. Thirty-eight teeth had less than 2 mm of ferrule, and 50 teeth had 2 mm of ferrule or greater. The dental arch, number, and location of the teeth included in the study are shown in Table 1. The clinician took radiographs and pre-, intra-, and postoperative photographs with a camera (Nikon F-801, Nikon) and Medical-Nikkor 120 mm lens (Nikon).

In 2014, we scanned and digitized the original slides with a scanner (Nikon Super Coolscan 5000 ED scanner, Nikon) to analyze the status of the teeth at baseline, the restorations, and the clinical techniques.

Clinical techniques. For all endodontic treatments, the clinician used the lateral condensation technique and endodontic cement (Sealapex, Kerr). The core preparations were not delayed more than 7 days. The clinician isolated the operative field with a rubber dam whenever there were posterior and anterior teeth in the same hemiarch. The clinician used hard copper bands cut to the height of the future core as the matrix (E. Hahnenkratt Dentale). This matrix allowed for isolation in the preparation areas where the ferrule was less.

The posts used were titanium (Unimetric, Dentsply Sirona). The clinician performed the endodontic preparations with penetration and calibration drills, leaving apical seals between 3 and 6 mm. The clinician chose a post width depending on the root canal diameter, as measured by a periapical radiograph (Table 2). The clinician chose the distal canal of mandibular molars and the palatal canals of maxillary molars for the post placement. The clinician used adhesive resin cement in white (Panavia Ex, Kurarai) for cementation following the manufacturer's instructions. Only 1 post was used in all cases. To supply additional retention in molars and premolars with 2 roots, the clinician made amalgam extensions into the root canals. The clinician removed almost 4 mm of gutta-percha from the canal with the conformation drill of the thinner post of the Unimetric system.

Once the posts were cemented, the clinician made the cores with amalgam (Tytin, Kerr) bonded with Panavia Ex. When the clinician made the amalgam core, he condensed it into the canals with a root canal plugger. Within 2 to 5 days, the clinician completed the preparation of the tooth using diamond burs making a chamfer (1-1.5 mm) on the tooth structure. The clinician made the impression for the metal-ceramic crown with addition-cured silicone (3M ESPE) (Figure 1). The clinician placed a crown on all teeth in the study. For all treated teeth, there was at least 1 adjacent tooth that did not retain a fixed or removable prosthesis and with occlusal contacts in the natural teeth.

In 2014, the treated teeth were re-evaluated. The posts and cores with crowns had been placed 18 to 22 years

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