An up to 3-Year Controlled Clinical Trial Comparing the Outcome of Glass Fiber Posts and Composite Cores with Gold Alloy–Based Posts and Cores for the Restoration of Endodontically Treated Teeth

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Purpose: This controlled clinical trial aimed to compare the 3-year outcomes of glass fiber posts and composite cores with gold alloy–based posts and cores for the restoration of endodontically treated teeth. ***Materials and Methods:*** One hundred forty-four patients in need of 205 restorations on endodontically treated teeth were selected and followed for 7 to 37 months (mean: 21 ± 9 months). The teeth were primarily stratified based on the remaining tissue available to restore the tooth core with or without a post. Then, randomization allocated the teeth to either test group 1 (prefabricated glass fiber posts), test group 2 (custom-made glass fiber posts), or test group 3 (composite cores without posts). The control group consisted of gold alloy–based posts and cores. All posts/cores were covered with all-ceramic single crowns. Failures were either absolute, such as root fractures or irreparable fractures of the post/core, or relative, such as loss of post retention or reparable fractures of the core. Success and survival probability lifetime curves, corrected for clustering, were drawn for the entire data set. ***Results:*** The recall rate at 3 years was 97.1%. Absolute failures consisted of two root fractures and one endodontic failure, while relative failures included three instances of retention loss of the post/core and one post fracture. Because of the low number of events, no statistical tests were performed. The success and survival probabilities over all groups together at 3 years amounted to 91.7% and 97.2%, respectively. ***Conclusions:*** After being followed for up to 3 years, both cast gold and composite post and core systems performed well clinically. Longer follow-up times are needed to detect possible significant differences. *Int J Prosthodont 2011;24:363–372.*

Restoration of endodontically treated teeth still remains a challenging issue in dentistry. Lack of tooth tissue many times results in insufficient retention of the restoration. Eventually, a root canal post may be needed to improve the anchorage of the core buildup material that eventually will retain the crown restoration.[1–3]

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Premolars and anterior teeth are more prone to nonaxial loading during (para)function compared to molars. The extra retention offered by a root canal post may then become beneficial in the former.[4] For molars, a post-retained core may be obsolete as a result of mostly sufficient thick dentin walls, the retentive pulp chamber, and the mainly axial loading direction.

When restoring an endodontically treated tooth, the extra retention offered by a post should be weighted against the sacrifice of healthy tooth tissue, which could eventually weaken the tooth.[5–7] One may wonder which procedure offers the most reliable outcome and provides the best cost/benefit ratio in the long run.

Several post materials, post designs, and techniques can be chosen.[8] The gold alloy–based post and core has been used for decades. In spite of its long clinical application, some important disadvantages remain. Invasiveness of the technique, especially in narrow root canals, and the extraoral fabrication procedure, leading to higher costs, have to be faced. In vitro studies have reported increased root fracture rates.[2,9–11]

Composite fiber posts were introduced in the early 1990s as an alternative to cast alloy–based posts and cores, as well as metal and ceramic posts.[12–14] Because their elastic moduli are claimed to be similar to that of dentin, the risk of vertical root fracture is said to be reduced.[2,3,11,15] Moreover, quartz or glass fiber posts (white or translucent) are used in situations of high esthetic demand.[16] Increased post retention and fracture resistance have been reported in vitro when posts were cemented adhesively compared to conventional cements.[17–20] The resultant homogenous entity in the adhesively cemented composite fiber posts allows a more uniform stress distribution in vitro, which may better protect the weakened tooth in the end.[12,13,21]

A large number of in vitro studies have compared different restorative techniques for endodontically treated teeth. However, different materials and methods have been used, which often lead to contradictory results.[22] Therefore, it is obsolete to encourage the clinical use of cast, metal, fiber, or no posts based on only those in vitro studies. Meanwhile, relevant information regarding the clinical comparison of the aforementioned techniques based on well-controlled clinical trials is still lacking.[23] Besides, the failure criteria reported in several studies are not always clearly defined. For this purpose, a 5-year prospective clinical trial was developed. The null hypothesis to be tested was that the direct composite fiber post/core techniques would have an equal survival probability compared to the indirect gold alloy–based posts and cores. This interim report will deal with the up to 3-year outcomes.

Materials and Methods

Between January 2006 and June 2008, all patients in need of single restorations on an endodontically treated tooth were screened at the Department of Prosthetic Dentistry, K.U. Leuven, Leuven, Belgium.

Patients who met the following criteria were excluded from the study: patients with serious medical conditions whereby a normal treatment and follow-up could not be guaranteed over a 5-year period, patients with known allergies to products that were planned to be used in the study, patients with untreated periodontitis or high decay sensitivity, and patients neither able nor willing to give informed consent for participation. Teeth that met the following criteria were excluded from the study: teeth that lacked coronal sound tissue over the perimeter of the tooth to obtain a ferrule effect and where crown lengthening procedures were refused or contraindicated to create the former, teeth for which an all-ceramic crown was not planned to be placed, teeth serving as abutments to retain a removable or fixed (partial) dental prosthesis, teeth without antagonists, teeth with a vertical root crack diagnosed under magnification (×3), teeth with recurrent endodontic complications, and teeth with crown fractures or caries extending below the bone level crest and where crown lengthening procedures were refused. Eventually, the latter three criteria for teeth resulted in tooth extraction.

Stratification/Randomization Procedure

Endodontically treated teeth were primarily stratified based on the remaining tooth tissue left to restore the tooth core with (insufficient) or without (sufficient) a post. Teeth with at least two walls of ≥ 2 mm of dentin thickness and with wide pulp chambers were considered as having sufficient remaining tooth tissue to bond the composite core without the use of a post. The clinical coordinator deemed it mandatory to specify teeth as having insufficient or sufficient cores. In case of doubt, the principle investigator was asked for his judgment as well, and consultation was organized until an agreement was reached. To calibrate both investigators, a series of extracted teeth (n = 20) were selected to help train them to correctly rate the remaining tooth tissue. From those teeth, slides were made to use as a reference in case of doubt (Fig 1).

Once the teeth were stratified as insufficient, they were randomized, with attention to allocation concealment, to either test group 1 (prefabricated glass fiber posts; Parapost FibreLux, Coltène-Whaledent) or test group 2 (custom-made glass fiber posts; EverStick, StickTech) and the control group (gold alloy–based post and cast cores; Parapost, Coltène-Whaledent and Medior 3, Cendres & Métaux).

To further stratify test groups 1 and 2, the diameter of the root canal was taken into account. The root canal was considered small when the perimeter was > 180 degrees at the root canal entrance and the 1.4-mm post drill—corresponding to the diameter of the prefabricated glass fiber posts used in this study—made contact with the root canal lumen; it was considered wide when it did not make contact, in cases of ovoid canals, or in canals in which the anatomical shape was lost because of preceding mechanical overinstrumentation (Fig 2). A prefabricated glass fiber post was used in the former (test group 1); a custom-made glass fiber post was used in the latter (test group 2).

Teeth that were stratified as sufficient were randomized, with attention to allocation concealment, to test group 3 (composite core without post; Clearfil AP-X, Kuraray and Clearfil SE, Kuraray) or to the control group

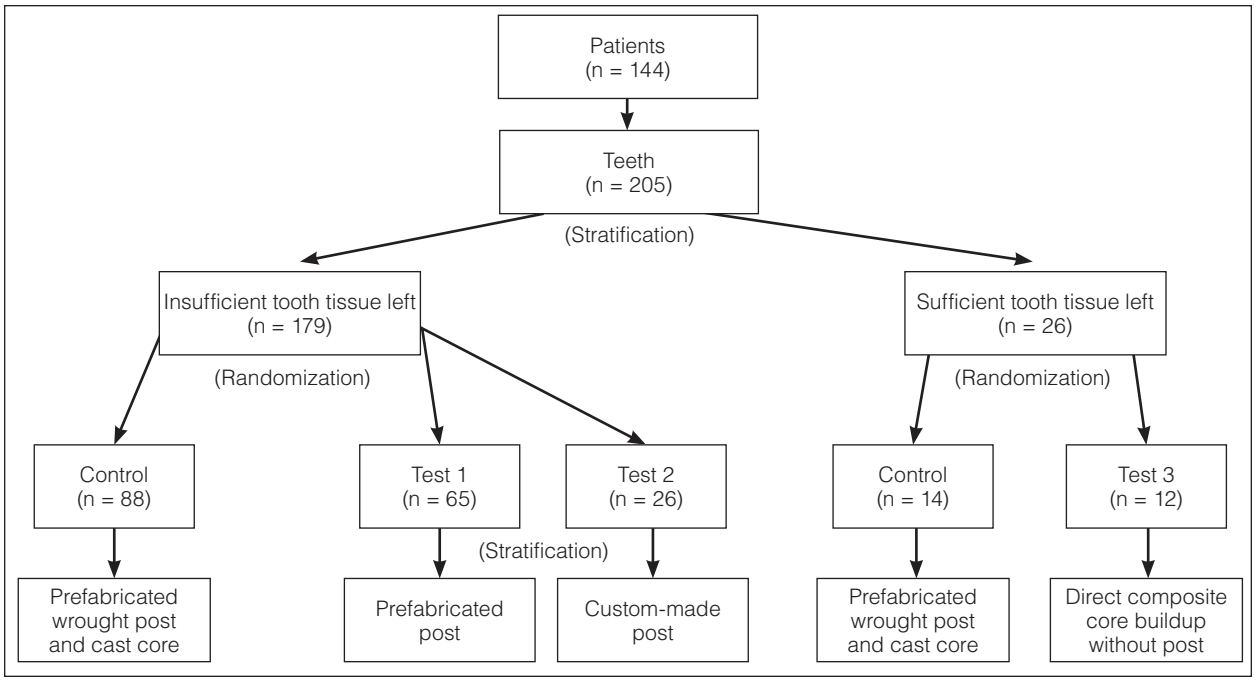

Fig 1 Flow chart of stratification/randomization of 144 patients in need of a single restoration on 205 endodontically treated teeth.

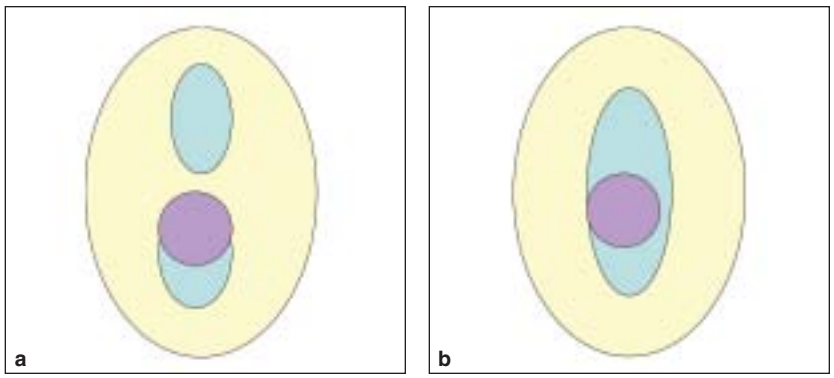

Fig 2 To further stratify test groups 1 and 2, the diameter of the root canal was taken into account. **(a)** The root canal was considered small when the perimeter was more than 180 degrees at the root canal entrance and the 1.4-mm post drill made contact with the root canal walls. **(b)** The root canal was considered wide when it did not make contact with the 1.4-mm post drill, in cases of ovoid canals, or in canals in which the anatomical shape was lost because of preceding mechanical overinstrumentation.

(gold alloy–based post and core; Parapost and Medior 3). In test group 3, the core buildup started from the pulp chamber and was only applicable in premolars and molars, because of their anatomical dimensions, to bond the composite directly without the use of a post (Fig 1).

The control group, consisting of a preformed wrought post and a cast core, only differed from the traditionally described full gold alloy–based post and core in that the cast post was replaced by a preformed wrought post that was cast onto the core. This strategy has been followed at the department over the last 25 years to avoid weakening the connection between cast post and cast core, especially in small-diameter root canals. Indeed, turbulence occurring during casting results in a porous cast and, eventually, in post fracture. Except for the apical third, where the post mostly is congruent with the root canal lumen, the technique does not adapt the post to the root canal. The mid- and coronal canal lumens are still waxed around the wrought post before casting, resulting in a thin cement layer and mechanically reliable post-core connection without additional weakening of the root.

To further standardize the procedure, all post/core systems were luted with the same dual-curing adhesive cement Panavia F 2.0/ED Primer II (Kuraray). In all test groups, the core was built with the same highly filled posterior composite (Clearfil AP-X) and bonded with the self-etch adhesive system Clearfil SE. All teeth were restored with all-ceramic single crowns (Procera, Nobel Biocare) luted with Panavia F 2.0/ED Primer II.

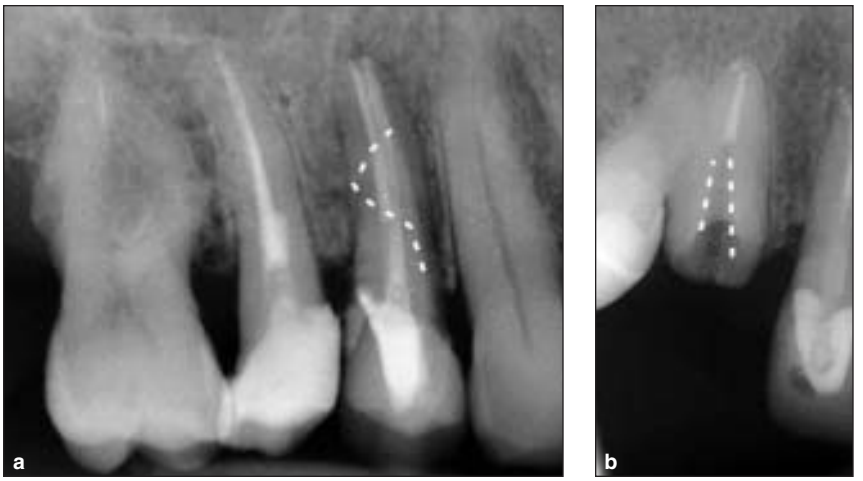

Fig 3 Examples of an **(a)** absolute and **(b)** relative failure. **(a)** The root fracture line *(dotted line)* of a maxillary premolar restored with a prefabricated glass fiber post (test group 1) is shown. After an explorative flap, the diagnosis was confirmed, and the tooth was extracted. **(b)** Custom-made glass fiber post (test group 2) that dislodged in an overinstrumented wide maxillary canine root.

Restorations were fabricated by 29 operators, who were all graduated dentists employed at the Department of Prosthetic Dentistry. A training session in which the protocol was theoretically explained in detail besides a preclinical hands-on training was given at the start of the study and repeated on a biannual basis for calibration purposes. All clinical procedures for post placement, composite buildup, and restoration cementation were performed strictly following the manufacturers' instructions.

Variables

Independent variables included: age and sex of the patients, tooth number, reasons for tooth restoration, remaining tooth tissue, size of the root canal lumen and restoration type, date of post and/or core insertion, and date of definitive crown placement. Dependent variables were: antagonistic status; marginal integrity, which was evaluated clinically (probing) and radiographically (good: restoration margin forms a continuity with the tooth without any decay, medium: decay grade 1 at the restoration margin but without cavity formation, bad: decay ≥ grade 2 at the border with cavity formation); occlusion and articulation patterns; and periodontal status (recession + pocket depth). The latter was evaluated over six sites (three labial/palatal and three facial). Three categories were distinguished: < 3 mm, 3 to 5 mm, and > 5 mm (Table 1).

Baseline and Follow-up

"Baseline" corresponds to the time of post and/or core placement, since all teeth were protected by a provisional restoration until the definitive restoration was ready and loaded. Follow-up of patients was scheduled after 1 and 3 years from the start of the study. All restorations were examined clinically and radiographically. Antagonistic status, periodontal status, marginal integrity, and occlusion and articulation patterns were evaluated. Baseline and follow-up examinations were carried out by one blinded clinical operator.

A distinction was made between absolute and relative failures. Root fractures or nonrepairable fractures of the post/core restoration (eg, impossible to remove the metal post without further weakening of the root) leading to tooth extraction were considered absolute failures (Fig 3a). Loss of post retention (in which recementation of the post and core could save the tooth) or repairable fractures of the core without further weakening of the tooth were considered relative failures (Fig 3b). Eventually, success was defined as the outcome in the absence of absolute and relative failures, while survival was defined as the outcome in the absence of absolute failures only. Endodontic failures were not considered in isolation. They were cumulative, and depending on whether the actual post and core was in situ were considered in both the success and survival lifetime analyses.

Whenever the fiber post (test groups 1 and 2) or the composite core (test group 3) fractured, the failed core buildup was replaced by a gold alloy–based post and core, but it was kept in its original group according to the intention-to-treat principle, as requested by the ethical committee of K.U. Leuven, to respect the patients' human rights. Depending on the failure mode, the same or a new all-ceramic crown was placed.

Chippings and fractures of the ceramic restorations were considered complications since they were not intrinsically related to the restoration of the root canal–treated tooth itself. All failures occurring in between consecutive follow-ups were recorded as well.

The study protocol was approved by the Ethical Committee for Clinical Trials of K.U. Leuven.

Table 1 Baseline Data of Restorations Included

	Cast core (control)	Prefabricated glass fiber post (test group 1)	Custom-made glass fiber post (test group 2)	Composite core without posts (test group 3)	Total
No. of restorations (%) at baseline	101 (100%)	65 (100%)	26 (100%)	13 (100%)	205 (100%)
Reason					
Caries	45	37	12	8	102
Trauma	14	5	1	1	21
Remake	38	21	12	3	74
Others	4	2	1	1	8
Tooth type					
Maxilla					
Incisors/canines	38	15	12	0	65
Premolars	27	24	4	3	58
Molars	5	6	1	3	15
Mandible					
Incisors/canines	2	1	0	0	3
Premolars	14	11	9	3	37
Molars	15	8	0	4	27
Antagonistic status					
Natural teeth	80	47	20	8	155
Removable prostheses	7	1	0	0	8
Restoration	11	15	3	2	31
Implants	3	2	3	3	11
Marginal adaptation					
Good	100	65	25	13	203
Medium	1	0	1	0	2
Bad	0	0	0	0	0
Periodontal status (pocket depth + recession)					
< 3 mm	101	65	26	13	205
3–5 mm	0	0	0	0	0
> 5 mm	0	0	0	0	0
Occlusion patterns					
No premature contact	101	65	26	13	205
Wear facets	0	0	0	0	0
Articulation patterns					
Frontal guidance	36	29	10	8	83
Canine guidance	25	16	5	2	48
Group guidance	39	20	11	3	73
Interferences	1	0	0	0	1

Statistical Analysis

Descriptive statistical analysis was performed using the software package SAS (SAS Institute). For descriptive purposes, frequencies (reported as number of cases) of the recorded parameters were plotted. Because of the few failures observed per group, it was not possible to plot the data in a more structured statistical model to search for statistically significant differences. Lifetime curves were drawn to estimate success as well as survival probability at year 3 over all groups together

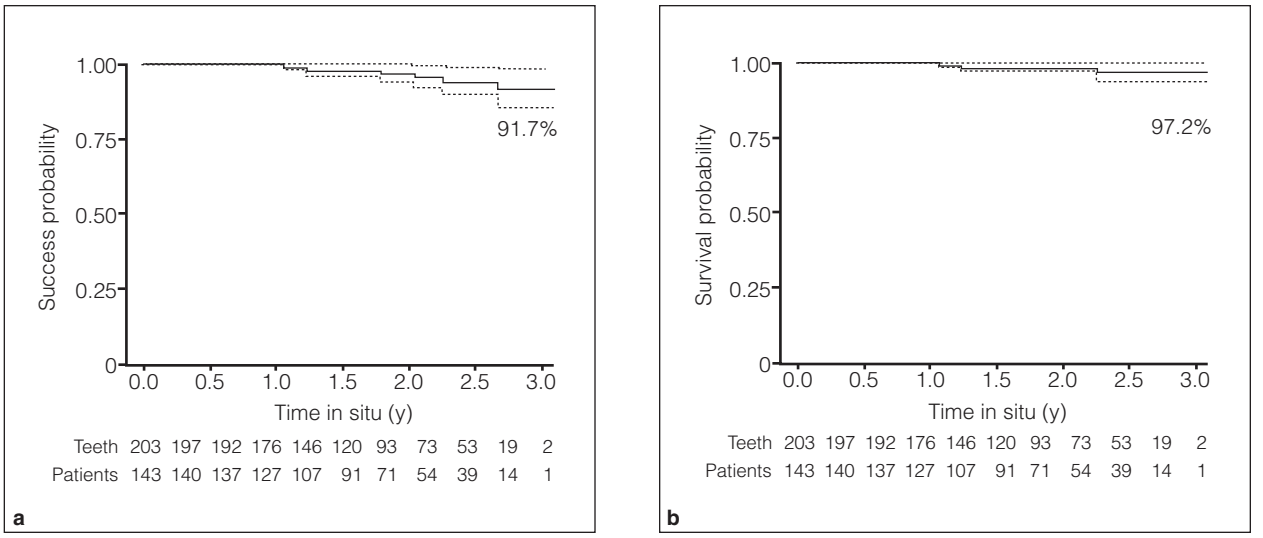

Fig 4 Lifetime curves, corrected for clustering, with 95% confidence intervals for **(a)** successful and **(b)** surviving root-treated teeth sampled over all groups. Patients and teeth for each time point are indicated as well. Survival/success probabilities are calculated from failure onward.

Results

Patients

Eventually, 205 restorations in 144 patients (53% women) with a mean age of 47 ± 8.7 years (range: 18 to 80 years) were included in the study after having signed a written informed consent form. The mean observation time was 21 ± 9 months (range: 7 to 37 months). The recall rate was 98.52% and 97.1% at 1 and 3 years, respectively. One patient with 2 restorations refused to take part at both the 1- and 3-year recalls and was considered a dropout. Four more patients refused or could not be reached by phone or email for the 3-year recall. In total, 6 restorations could not be scored (4 belonging to the control group, 1 to test group 1, and 1 to test group 3) and were considered as censored. One patient refused radiographs to be taken at recalls but was not considered a loss to follow-up.

Root Restorations

Of the 205 teeth, 87.32% were rated as having insufficient remaining tooth tissue; the remainder (12.68%) were sufficient. A small root canal was found in 65.37% of the teeth, while 28.78% were rated as wide. In 5.85% of teeth, a composite core without a post was the treatment of choice (Table 1).

One hundred two (49.76%) restorations were gold alloy–based posts and cores, 65 (31.71%) were prefabricated glass fiber posts with composite cores, 26 (12.68%) were custom-made glass fiber posts with composite cores, and 12 (5.85%) were composite cores without posts. Seventy percent (n = 102) of patients had one restoration only, while 27, 12, 2, and 1 patients had 2, 3, 4, and 5 restorations per patient, respectively.

Failures

No absolute, relative, or endodontic failures were observed at the 1-year recall. Thus, a 100% success rate was obtained. However, four all-ceramic restorations showed complications such as chipping of the layering ceramic (n = 3) or fracture (n = 1). The former were polished, while the latter was replaced and the tooth was kept in function.

At 37 months, two absolute failures were observed: one in the control group (mandibular premolar) and one in test group 1 (maxillary premolar). Both were root fractures, and the teeth were eventually extracted. One tooth belonging to test group 1 (maxillary incisor) failed because of endodontic failure, eventually leading to extraction of the tooth. Four relative failures were observed: three of them were dislodgements of the post (two belonging to the control group [maxillary canine and premolar] and one to test group 2 [maxillary canine]). The other relative failure was a fracture of a gold alloy–based post and core (control group) in a maxillary canine. Eventually, the post was removed without further weakening of the root. Because of the low number of events, statistical analysis was not relevant.

Table 2 Evaluation of Results at 3-Year Recall

	Cast core (control)	Prefabricated glass fiber post (test group 1)	Custom-made glass fiber post (test group 2)	Composite core without posts (test group 3)	Total
Recall rate	97 (95.10%)	64 (98.46%)	26 (100%)	12 (100%)	199 (97.1%)
Tooth type					
Maxilla					
Incisors/canines	37	15	12	0	64
Premolars	27	23	4	3	57
Molars	5	6	1	3	15
Mandible					
Incisors/canines	2	1	0	0	3
Premolars	14	11	9	3	37
Molars	12	8	0	3	23
Antagonist status					
Natural teeth	76	46	20	7	149
Removable prostheses	7	1	0	0	8
Restoration	11	15	3	2	31
Implants	3	2	3	3	11
Marginal integrity					
Good	71	57	19	12	159
Medium	26	6	7	0	39
Bad	0	1	0	0	1
Periodontal status (pocket depth + recession)					
< 3 mm	58	44	20	12	134
3–5 mm	34	17	5	0	56
> 5 mm	3	2	1	3	9
Occlusion patterns					
No premature contact	94	62	26	12	194
Wear facets	3	2	0	0	5
Articulation patterns					
Frontal guidance	26	18	5	4	53
Canine guidance	24	18	9	2	53
Group guidance	46	28	12	6	92
Interferences	1	0	0	0	1

Lifetime curves, corrected for clustering, were drawn for successful and surviving teeth over all groups together (Figs 4a and 4b). At year 3, the success and survival probabilities were 92.3% and 93.7%, respectively.

Between the 1- and 3-year recalls, complications occurred. Three ceramic crowns fractured and were replaced. Two ceramic crowns showed chipping of the porcelain layering and were polished and remained in function.

Other Parameters

Because of the few failures observed, only descriptive statistics referring to the 3-year recall were reported (Table 2). No increased risk for the investigated parameters could be observed for any of the post and core techniques used. There was a shift in marginal integrity from good to medium between baseline and the 3-year control, independent of the post and core technique used.

Discussion

In the present clinical trial, the survival probability of endodontically treated teeth restored with either the gold alloy–based post and core or with the three alternative composite fiber post/core adhesive techniques was defined. Following a proper prosthodontic treatment plan, a total of 205 restorations were placed in 144 patients and followed for up to 3 years. No statistical test was performed in any of the groups because of the low number of events. Indeed, any classical statistical procedure that aims to compare the failure rates in treatment groups would be flawed since they are based on large sample arguments, where the sample size is primarily based on the number of uncensored events. Therefore, any statement about comparative performance in this report is purely descriptive.

The overall survival and success probabilities were 97.2% and 91.7%, respectively. This outcome is in the same range as those reported by previous prospective and retrospective clinical trials in which the survival rates of endodontically treated teeth were assessed.[24–29] However, the survival rates are difficult to compare because of differences in study designs. Failure rates of 3.2% and 1.7% have respectively been reported in two retrospective studies.[28,29] In the former, the clinical performance of carbon and glass fiber posts was evaluated over a period of 1 to 6 years. In the latter, 180 restorations with quartz fiber posts were followed for 30 months. Another retrospective study reported survival rates of 2% and 5% after 32 and 48 months of clinical service, respectively, for carbon fiber posts.[30]

Regarding the prospective studies, Glazer[31] reported a failure rate of 7.7% for carbon fiber posts with clinical service in the range of 7 to 45 months. A prospective clinical trial in which carbon fiber posts were compared to a gold alloy–based post and core found failure rates of 25% and 9%, respectively.[32] However, a small number of restorations were followed in both of them.[24] Naumann et al[33] reported that 3.8% and 12% of restorations with glass fiber posts failed after 12 and 28 months, respectively. They observed 31 failures, resulting in an average annual failure rate of 6.7% for 149 glass fiber posts that were followed for 5 to 59 months. The current authors did not observe this high failure rate with glass fiber posts.

In the present study, a distinction was made between absolute and relative failures depending on the possibility to repair and keep the tooth in function. Both absolute failures were root fractures and dealt with premolars treated with a post. This finding suggests that preceding additional tissue removal of the root canal may be crucial in the decision to place a post when restoring teeth with small and thin roots, such as in premolars.

Several in vitro and in vivo studies emphasized the role of the residual coronal dentin available for bonding in the survival of endodontically treated teeth. In particular, it has been suggested that the load capability of a tooth is a function of the creation of a ferrule effect. Indeed, a ferrule of 2 mm has been found to be effective in increasing the fracture resistance of teeth restored with a post.[6] Because the favorable impact of the ferrule is well known, teeth were only included in this trial if a ferrule of 1.5 to 2.0 mm could be reached over the entire perimeter of the tooth. Creugers et al[5] observed that the survival rate of endodontically treated teeth restored with substantial dentin height had a higher survival rate than teeth with minimal dentin height, regardless of the use of a post.[5,26]

Regarding the relative failures observed in this study, the most common type of failure was dislodgment of the post, which is in line with previous clinical findings.[24,26,28,29,32,34] Both gold alloy–based posts and cores and glass fiber posts were involved, and three of them were in maxillary canines. Failures occurred in the anterior region, which is in line with previous clinical studies that demonstrated that restorations placed in incisors or canines had a failure rate approximately three times greater than that of restorations placed in premolars or molars.[33–35] One post dislodgement occurred in a tooth restored with a custom-made glass fiber post (Everstick). This approach allows the fibers to be adapted to the anatomy of the root canal, and it is indicated to restore ovoid large root canals and canals where the anatomy is lost as a result of preceding excessive mechanical preparation.[36–38] Although it has been reported that Everstick fibers have higher flexural properties compared to prefabricated fiber posts, the application of the former is not user-friendly. Furthermore, a 3-year prospective clinical trial revealed that endodontically treated premolars restored with quartz fiber posts had lower failure risks than premolars restored with Everstick.[39]

In the current study, all posts were luted with Panavia F 2.0. This adhesive cement is based on a mild self-etching approach, which appears to be less technique-sensitive, and this may be of help in narrow and deep root canals.[40] Furthermore, besides its micromechanical adhesive mechanism, it should be mentioned that the cement contains the phosphate-based functional monomer 10-methacryloxydecyl dihydrogen phosphate. This molecule has been found to chemically interact with the hydroxyapatite left around the collagen within the hybrid layer,[41] and this interaction appears essential for the long-term stability of the bond.[42]

One fracture of a gold alloy–based post and core may be ascribed to the use of a 1.4-mm-diameter post in a canine. Even though prefabricated cast posts (Au-Pt Parapost) were used in the control group, the tension stress, especially during canine rise, might have exceeded the mechanical properties of these small-diameter posts.

Besides tooth type and position in the dental arch, the type of definitive restoration (single crowns versus fixed partial dental prostheses) and the absence of approximal contacts have been proposed as significant predictors for failure.[33,43] In this study, only single teeth restored with all-ceramic crowns and with antagonists were selected, which is considered less favorable than when fixed partial dental prostheses are used.

Although no increased risk for the investigated parameters could be demonstrated for each buildup approach, a shift in marginal integrity from good to medium was observed. This was partially because of cement wash-out at the margins and, to some extent, grade 1 decay formation at the margins. However, only one restoration, in function for 31 months, was rated bad and needed a Class V composite filling as a result of grade 2 decay formation. The difference in periodontal status with a small increase from < 3 mm toward 3 to 5 mm may have been a result of the subgingivally located crown margins in some patients. Both parameters underline the importance of motivating patients for good oral hygiene and the use of fluoridated toothpaste to keep teeth and soft tissues healthy.

With regard to the single endodontic failure, this might have been caused by reinfection of the periapical area, probably related to a loss of coronal seal.

In spite of the rather long intake period of 2.5 years and the large sample size of 205 restorations, few failures were observed. The latter is a limitation to drawing final conclusions. A 5-year recall of all restorations in function is underway.

Conclusions

For up to 3-years, both cast gold and composite fiber post/core systems performed well clinically. Contrary to some reports, the glass fiber posts did not behave worse than gold alloy–based post and cores in the short run. Longer follow-up times are needed to detect possible significant differences.

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Literature Abstract

Oral rehabilitation with osseointegrated implants in oncologic patients

The aim of this retrospective study was to report the long-term results of implant-based dental rehabilitation of oncologic patients reconstructed with pedicled or free microsurgical flaps in a university hospital setting over 15 years. The study comprised 111 patients (mean age: 52 years). Ninety patients presented with malignancies and 21 presented with ameloblastomas; 12 patients had maxillary lesions and the remaining 99 presented with mandibular lesions. A total of 706 hydroxyapatite-coated titanium implants were placed, with 252 implants placed in grafted bone and 454 placed in remnant bone. Three hundred forty-eight (49.3%) implants were inserted in the mandible and 358 (50.7%) implants were placed in the maxilla. Implants were exposed after 6 months in nonirradiated patients; irradiated subjects had implants exposed 8 months from the time of implant placement. All patients received implant-supported prostheses. Twenty-nine (4.1%) implants did not osseointegrate; 27 of the 29 nonosseointegrated implants occurred in irradiated patients, and all were located in areas of maximum radiation dose. Twenty-one of these 27 implants were placed immediately during bony flap reconstruction. Fifty-two (7.4%) implants failed after prosthetic loading in 8 patients. In these 8 patients, 7 received radiotherapy. Forty-eight implants of the 52 placed in these patients were exposed to radiotherapy; in turn, 40 of these 48 implants were in the maximum radiation zone. Thirty-one (4.4%) malpositioned implants could not be used. The total implant failure rate was 15.9%. The authors concluded that implant failure was intimately associated with maximum radiation dose, immediate implantation at the time of reconstruction, and the use of osseomyocutaneous trapezial flaps. They also recommended a clinical protocol in the handling of this challenging patient population.

Cuesta-Gil M, Ochandiano Caicoya S, Riba-García F, Duarte Ruiz B, Navarro Cuéllar C, Navarro Vila C. *J Oral Maxillofac Surg* 2009;67:2485–2496. **References:** 27. **Reprints:** Dr Navarro Cuellar, Oral and Maxillofacial Department, Hospital Genral Universitario de Guadalajara, Donantes de Sangre s/n, 19002 Guadalajara, Spain. Email: cnavarrocuellar@gmail.com—*Elvin W.J. Leong, Singapore*