Clinical Studies of Posts

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The literature on posts is dominated by nonclinical studies and practice-based, nonrandomized clinical trials. The number of teeth studied in these trials is often, on its face, impressive. Less evident is the quality of the evidence provided. The present review seeks to investigate the strengths and weaknesses of several of these studies.

Clinically Significant Factors in Dowel Design

J.A. SORENSEN, J.T. MARTINOFF
Journal of Prosthetic Dentistry 1984 (52:28–35)

ABSTRACT

Objective: The study used 1,273 endodontically treated teeth to:

1 Compare the clinical success rates of six coronal-radicular stabilization methods
2 Record the failures of dowel systems and their effects on endodontically treated teeth
3 Determine the effect of dowel length on the clinical success rate

Materials and Methods: The dental records of 6,000 patients of nine dentists were examined. Three parameters were investigated, with the first being the method of reinforcement used. Six separate reinforcement methods were included in the study:

1 Tapered cast dowel and core
2 ParaPost (Whaledent International, New York, NY, USA) and amalgam or composite resin core
3 Cast ParaPost and core
4 Threaded post
5 Pin-retained amalgam core
6 Pin-retained composite core

The second parameter was dowel length. This was determined radiographically, measured as a ratio of post length to crown length, and recorded to the nearest one-fourth of crown length. Recorded responses ranged from a dowel one-quarter to two times the length of the clinical crown.

The third parameter was failure mode. Two major categories of failure were included: restorable and nonrestorable. Restorable failures were further categorized as the result of tooth fracture or dislodgment. Nonrestorable fractures were placed into one of three subcategories: tooth fracture, vertical root fracture, or iatrogenic root perforation.

Teeth present for less than a year after endodontic treatment or lost because of periodontal disease or caries were excluded from the analysis.

Results: A total of 65.4% of teeth were restored without reinforcement. The failure rate for these was 10.1%. Tapered post and core was the most frequently used form of reinforcement (19.2%) and had a failure rate of 12.7%. ParaPost in conjunction with amalgam

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or composite core was used 10.4% of the time and had a failure rate of 2.3%. Cast ParaPost and core was used 3.0% of the time with no failures. Pin-retained composite cores were used 1.0% of the time with a 7.7% failure rate. Pin-retained amalgam cores were used 0.6% of the time with 25.0% failures. Finally, threaded posts were used 0.4% of the time with 40.0% failures. Failures were relatively few in number and distributed various treatments. As a result, it was not possible to generalize about the relative value of the methods used.

Of teeth restored with dowels, 97.6% of those with failures were because of fracture, and 40% of those were nonrestorable. Overall, nonrestorable failures occurred 39% of the time. For teeth restored without reinforcement, 38% of failures were nonrestorable. Teeth restored with ParaPost and amalgam or composite experienced 33% nonrestorable failures. For tapered cast dowels and posts, 39% of failures were nonrestorable. Teeth restored with a pin-retained amalgam core experienced nonrestorable vertical root fractures in 50% of those that failed.

When dowel length was less than three-fourths the clinical crown length, the failure rate was 15%. When dowel length equalled crown length, the rate was 2.5%. When the dowel was longer than the clinical crown the rate fell to zero. By comparison, for teeth without a dowel, the failure rate was 10.2%.

Conclusions:

1 The ParaPost, either with a cast core or an amalgam or composite core, had the highest success rate
2 The tapered cast dowel and core had a higher failure rate than teeth treated without intracoronal reinforcement
3 The parallel-sided serrated dowel did not have failures caused by tooth fracture, whereas failures of the tapered cast dowel and core required extraction in approximately one-third of the fractured teeth
4 Teeth that had a dowel length equal to or greater than the crown length had a success rate that exceeded 97%

COMMENTARY

Although this is an older study, it is included because it illustrates the limitations of a nonrandomized, retrospective study.

Data covering 1,273 teeth are impressive and certainly offers many valuable insights. However, things are not always exactly as they appear. First, rather than 1,200 teeth, only roughly 400 were treated using posts. Second, the results of treatment are very much tied to the abilities and the practice patterns of the nine dentists whose patient records were evaluated. Regarding ability of the operator, 38 teeth were treated with a cast ParaPost and core and all were successful. In this type of study, it is simply unknown whether nine dentists each placed approximately 4 of these types of restorations or one dentist, who preferred this method and was particularly skilled, placed all 38. Although 38 teeth out of 400 are not dramatic, the point is that not all dentists have equal ability. In this type of study, there was no standard protocol for treatment and perhaps not all treatments were performed by all dentists. Also, there is no baseline evaluation performed by an independent evaluator that establishes clinical acceptability. A further concern about practice patterns is that in this type of study the type of post can be easily and quickly discerned. However, recording and cataloguing all other methods and materials that went into restoring each tooth would be very difficult. In addition to the patient factors, the success of any individual tooth is determined by the operator's ability and the specific techniques and materials used. Thus it is problematic to focus strictly on issues such as post-type while being unaware of so many other factors. In this situation, making comparisons based on cases that are dissimilar in so many ways does not provide a basis for making firm decisions.

Practitioners treat patients. Their primary concern is to provide successful treatment at a reasonable fee; it is not to conduct research. Accordingly, many practitioners would evaluate a tooth with ample remaining tooth structure and choose composite as the most efficient material to restore adequate structure for good resistance and retention form. Where remaining

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tooth structure is adequate but not ample, many practitioners would choose amalgam as a better choice. For these practitioners, this would exemplify an established practice pattern. The results presented showed that a pin-retained amalgam core failed at a rate three times that of a pin-retained composite core. Because the method used to restore the tooth is a major focus of the study, it would be natural for the reader to conclude that the pin-retained amalgam core is an inferior choice. In truth, the study design is simply not adequate to support that sort of conclusion. It has long been theorized and more recently established that the amount of remaining tooth structure is an important predictor of success in restoring endodontically treated teeth. Although several important factors related to treatment success were included in this study, the amount of remaining tooth structure was not one of them. Because of the limits of the study design, the relative amount of tooth structure remaining for teeth restored by each method is unknown.

As a result of this study limitation, rather than the method used to restore the tooth explaining the results observed, they can just as completely be explained as a reflection of the practice patterns of these practitioners. More simply put, the use of amalgam versus composite is likely to be a proxy for how much tooth structure remained. Similarly, tapered cast dowels failed more frequently than teeth treated without a dowel. Because one chooses not to use a dowel when there is ample remaining tooth structure, the lack of a dowel becomes a proxy for the amount of remaining dentin height. In both cases, the conclusion that the results were a function of the method used would be tenuous. Because remaining dentin height is known to be a major factor in predicting success, the failure rates are more likely caused by the amount of remaining dentin height.

One of the purposes of the study was to investigate methodology. Much valuable information is presented in this type of study, and the profession is advanced by having the data. However, as a result of the design, it simply cannot offer strong evidence as to which treatment method is best. Success or failure can be accurately gauged from records but is a rather crude measure. Which is of more value, a post that failed at 15 years or a success at 2 years? Given the variation in the number of teeth treated by the various methods, it is very difficult to determine by percentages alone whether there were significant differences between treatment methods. A second purpose was to investigate failure modes. Here again the differences in the distribution of treatments and failures make it difficult to be confident about any trends from visual inspection alone. The authors were unable to provide statistical testing for any of their data.

As for the investigation of dowel length, the data trend is impressive. However, the same problems exist. Longer lengths are more easily achieved for some teeth than for others. As a result, one must consider the possibility that dowel length is simply a proxy for tooth type. Thus tooth type rather than dowel length may explain the results observed. Given the limits of the study design, it is impossible to discern which factor is more important. But the strength of the trend gives this observation a little more weight.

A stronger study design, such as randomized clinical trials (RCTs), would overcome these issues. Unfortunately, RCTs are much more difficult to conduct, are expensive, and take longer to yield results. Accordingly, they are far less prominent in the literature. By contrast, an RCT would establish inclusion criteria that would assure that all teeth accepted into the study had a reasonable chance of success. Further, the treatment methods being studied would be assigned at random. These two features control the problem discussed relative to practice patterns. As a result, it would be highly unlikely that the success of any treatment method would be the result of an unknown factor, such as remaining tooth structure or tooth type, rather than simply a reflection of that method's inherent clinical advantages. RCTs are prospective. Teeth are evaluated for acceptability at baseline and followed for the same time frame. Typically, evaluations are not performed by the same clinician who placed the restoration. This controls bias in the evaluation process. These features minimize the concern over differing abilities among operators and create a scenario in which meaningful statistical

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comparisons can be made. Finally, treatments included in the study are compared with a treatment method about which much is already known. This can take the form of untreated teeth, teeth treated by the most widely accepted method, etc. A control group provides a basis for comparisons with previous studies. If the result for the control group is extraordinarily good or bad relative to the published literature, it gives the reader an insight into how this particular study was conducted.

In summary, this type of study is easier, less expensive, and yields results much more quickly than RCTs. It provides good information that is relevant to practice. The more dramatic data trends such as the failure rate for screw posts and the data on dowel length can be given more weight than the more equivocal data. However, all of the data should be viewed critically. It should not be viewed as proof positive. Rather, it should be used as a guide until stronger evidence such as that offered by an RCT comes along.

Retrospective Study of the Clinical Performance of Fiber Posts

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American Journal of Dentistry 2000 (13:9B–13B)

ABSTRACT

Objective: To use a retrospective study to evaluate the performance of C-Posts, AEstheti Posts, and AEstheti Posts Plus (all from Bisco, Inc., Schaumburg, IL, USA).

Materials and Methods: During a 6-year period, three dentists placed 1,314 fiber posts. These teeth were evaluated clinically and radiographically every 6 months. For the first 3 years, only C-Posts were placed. For the next 4 months, both C-Posts and AEstheti Posts were placed. For the remainder of the study C-Posts and AEstheti Posts Plus were placed. Over the 6 years 850 C-Posts were placed for 719 patients. During roughly a 4-month period, 249 AEstheti Posts were placed for 215 patients. Over the final 24 months covered by the study, 234 patients had 290 AEstheti Posts Plus placed.

Four different dentin bonding systems were used to bond the posts. Buildups of the abutment cores were accomplished using different brands of composite. For C-Posts and AEstheti Posts, one brand of composite predominated, whereas for AEstheti Posts Plus another brand was used predominately. Teeth were restored using three different methods: (1) ceramometal crowns (52%); (2) ceramic crowns (38%); and (3) resin-based composite (10%).

Data for the study were obtained by clinical and radiographic examination, and by using notes recorded at periodic examinations. The timing of evaluations performed specifically to gather data at the close of this study was not clear. At least two of the three dentists performed study examinations of their own patients. They were not blinded as to which post had been placed. It was not clear who did evaluations for the third dentist. Radiographic examination was completed using 5× magnification.

The post was deemed a success if it was in place without clinical or radiographic signs of technical failure, loss of retention, root fracture, or post fracture. The description of the materials and methods used does not include any evaluation and recording of the amount of remaining tooth structure. Actuarial Life Table statistical analysis and Mantel–Haenszel comparisons of survival curves were performed at a 95% level of confidence.

Results: Twenty-five teeth were considered as failed because of debonding of the post. These failures were almost equally distributed among the four bonding systems. It was reported that all debonded posts were originally bonded to teeth with less than 2 mm of remaining dentin. The radiographic presence of periapical lesions resulted in an additional 16 teeth being considered failures. All were treated with C-Posts and all were asymptomatic.

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The overall failure rate was 3.2%. No statistically significant differences were found among the four groups. The 25 failures caused by debonding were attributed to the bonding system, and the 16 other failures were "clearly caused by endodontic reasons." Thus no technical failures caused by the fiber posts were recorded.

Conclusions: The results of this retrospective study indicate that fiber posts in combination with bonding can be routinely used.

COMMENTARY

Although the number of teeth studied is impressive, again, the concerns expressed about the previous study apply. Here, the problem of practice patterns among dentists is more evident. The distribution of the three posts is quite different, both in terms of numbers placed and years of service. It appears that each of the three posts had a turn as the clearly dominant post placed for a specific time period during the study. Potentially, success rates may be a reflection of the increasing skills of the operators and/or the use of improved restorative materials not previously available rather than the type of post.

The authors dismiss all failures as unrelated to the posts themselves. In my opinion, the success of any case depends on many factors. As a result, in any study in which there is such a wide variety of treatment combinations, it is difficult to envision having enough confidence in the data to come to any firm conclusions. As noted earlier, the lack of randomization is a major weakness in this type of study design. In an RCT, a very limited number of treatment combinations would be assigned at random. As a result, it would be highly unlikely that factors known or unknown would differ significantly from one treatment group to another.

The authors dismiss debonding as being correlated to any aspect of the post. Instead, it is ascribed to weaknesses in the bonding system or a lack of remaining dentin height. Similarly, the presence of periapical lesions was considered to be the result of the endodontic treatment, with no consideration given to the possibility of leakage. This brings up the question of bias. One is much more likely to be dismissive of alternative explanations for the data when one is convinced before the start of the study that a specific treatment is good or bad. In the present study, clinicians were aware of which type of post had been used at the time evaluations were performed. In a good RCT, this would not be the case. All of us have personal biases about which treatments work and which do not work. The key is to control such biases by a stronger study design, that is, blinding of evaluators.

The overall success rate appears to be very good, but just over one-third of the posts were about 2 years old or less, and the oldest was only 6 years. The abstract indicates that survival curves were calculated and a comparison was performed. There is no description of the statistical procedures in the Materials and Methods section. It was reported that there was no significant difference between the four groups. Logically, a comparison of survival rates would focus on the three types of posts used rather than the four types of cements used. It is unclear exactly what comparison was made.

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Restoration of Endodontically Treated Teeth with Carbon Fibre Posts—A Prospective Study

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ABSTRACT

Objective: Evaluate the success of carbon fiber-reinforced epoxy resin posts using a prospective study.

Materials and Methods: During a 3-year period, all patients who were treated with a carbon fiber post, 38 Composiposts (Bisco, Inc., Schaumburg, IL, USA) and 14 Endoposts (Biodent, Pointe-Claire, Quebec, Canada), resin core and a full-coverage ceramometal restoration were enrolled in the study. Teeth had generally lost 50% of coronal structure, but all teeth had a minimum of 2.0 mm remaining dentin height. All teeth were treated using the same bonding agent and build-up material. During the study period 59 posts were placed for 47 patients. Eventually, five patients and seven posts were lost to follow-up.

Patients were evaluated annually. The author placed all restorations. Evaluations were conducted by the author except in situations where the patient was unable to return to his practice. In those cases, the referring dentist conducted the evaluation with the author providing guidance about study protocols via telephone. Evaluations for six posts were completed this way. Biological failure was defined as the presence of caries, periodontal disease, or endodontic failure. Mechanical failure was defined as debonding of any aspect of the tooth-post-core-crown complex or the presence of a fracture.

For each post the time, in months, between insertion of the post and either the date of the last evaluation or the date of failure was calculated. Several factors were included in statistical analyses: (1) age; (2) sex; (3) tooth type (incisor, etc.); (4) tooth location (anterior or posterior); (5) tooth location (dental arch); (6) prosthetic status (single tooth or FPD abutment); and (7) post type (Composipost or Endopost). These were first evaluated individually using the Kaplan–Meier statistic to estimate the impact of each factor on the survival time (in months). These factors were also evaluated using a log rank procedure and a Cox regression analysis.

Results: Four failures were recorded. Two were biological and two were mechanical. The failure rate was 7.7%. The shortest time to failure was 7.0 months and the longest was 29.3 months, with a mean of 20.0 months. Using the Kaplan–Meier statistic, a mean survival time of 43.4 months was calculated. There was no statistically significant difference between the Composiposts and the Endopost. The results of the additional testing indicated that tooth type was a significant predictor of failure. Specifically, lower premolar teeth failed at a significantly higher rate than others.

Conclusions: Carbon fiber-reinforced epoxy resin posts are among the most predictable systems available today.

COMMENTARY

Unlike the first two articles, this study was prospective rather than retrospective. A prospective study allows the researcher to include factors that are presently known to be important. By contrast, in retrospective studies treatment protocols and the types of data available have already been established before the study data are collected. The author did not take advantage of this. From the study conclusion, it is apparent the author would like to have made comparisons of fiber post performance with other available posts. With a prospective study the author could have included a well-known treatment such as a ParaPost, but did not choose to do so. Rather than representing a strengthening of the study design relative to the two retrospective studies there is little difference.

Strengths of the study include a standardized treatment protocol and well-defined criteria for success that are

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restrictive. There is no attempt to dismiss failures as not being related to the posts. However, these strengths are far outweighed by the study's weaknesses. Most importantly, there is no randomization of treatment, there is no blinding of the evaluator and there is no control group that has a well-established success rate established in the literature. It includes a much smaller sample size and a shorter time frame than the first two studies. Similar to the first two studies, treatment distribution between the two posts is quite dissimilar.

As with the Ferrari study, actuarial techniques were used for statistical analysis. These tests are designed for use on extremely large data sets where it can be safely assumed that events such as sickness, death, etc., occur at a regular rate that differs little from year to year. Many statisticians do not believe that such an assumption can be made about failures in this sort of setting. In the present study these tests indicate that mean survival will be 43.4 months. Yet the mean age of the posts in the study was only 20 months, and the total length of the study was only 36 months. Thus survival curves based on data collected to date are used to predict future performance. The use of survival curves is fairly common in the literature on posts. Again, statisticians differ in opinion on the appropriateness of this type of analysis in this setting.

The author's conclusion implies comparison of these two carbon fiber posts with other post types that were not included in the study. Especially in a prospective study, the researcher should be able to anticipate which factors are important and include them in the study. If the author had chosen to include a comparison group, the study would have been strengthened and comparison with any included treatment alternatives would have been appropriate. Absent inclusion of this type of treatment alternative, it is inappropriate to conclude fiber posts are "among the most predictable systems available today." Again, statements such as this bring the question of bias to mind. Recall that the average failure rate was 7.7% for posts that were on average 20 months old and the predicted mean survival rate was 43 months. These results are not impressive enough that one should go out of his way to make broader comparisons.

5-Year Follow-Up of A Prospective Clinical Study on Various Types of Core Restorations

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International Journal of Prosthodontics 2005 (18:34–9)

ABSTRACT

Objective: The first objective was to compare the survival rates of three types of buildups in endodontically treated teeth: (1) a cast post and core; (2) a direct post and composite core; and (3) a post-free, all composite core. Teeth were subsequently restored with crowns. The effect of remaining dentin height was investigated as well.

Materials and Methods: This was a multicenter RCT. One center was based at a university, and 17 others were based at private practices in the surrounding area. The techniques, the study protocols, and the materials to be used were reviewed before the start of the trial. Inclusion criteria were defined before the start of the study and were to be strictly adhered to. The university enrolled 72 patients needing 106 restorations, and the practitioners enrolled 177 patients needing 213 restorations.

First, the expected dentin height remaining after preparation was evaluated. Two categories were defined by the protocol: The first was "substantial dentin height" (Group S) and was defined as the expectation that a collar of 1 to 2 mm would be achieved. The second was "minimum dentin height" (Group M) and was defined as the expectation that a collar of 1 to 2 mm would not be achieved. Following classification to one of these two groups, one of the three types of buildups was assigned at random.

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Evaluations were completed every 6 months, and patients were instructed to return at any time they had or suspected a problem with their tooth. The minimum follow-up time was 5 years. Six types of failure were defined before the start of the study: (1) dislodgement; (2) dislodgement with accompanying loss of tooth structure; (3) fracture of the core; (4) fracture of the post; (5) fracture of the root; and (6) loss of the tooth.

The principal investigator was based at the university. He took several steps to assess the compliance with the study protocols and the quality of the study data. The classification of remaining dentin height was evaluated for every tooth restored using models made from an impression taken expressly for that purpose. He also conducted a review of the records at 12 randomly chosen practices. Towards the end of the study he performed clinical evaluations of 50 patients chosen at random, comparing the results of his exam with those recorded by the operator. In all cases he found compliance to be good.

Results: Two investigators had a disproportionate number of failures. One-third of all failures was found in the first month of the study and were from these two practices. Because these failures were root fractures and unrelated to aging and the fatigue process, they were excluded from the survival analysis.

Over the remainder of the study there were 10 other failures in 314 restorations (3%). Excluding the five early fractures, there were no statistically significant difference between the three build-up methods used. Survival rates were 98% and 93% in Groups S and M, respectively, and the difference was statistically significant.

Six teeth failed because of dislodgment, four with additional loss of tooth structure. Seven, including the five early failures, failed because of root fracture. Two teeth were extracted, but the reason for extraction was unknown.

A post hoc review of the study by the principal investigator raised concerns about compliance with the protocol. In 23 instances, practitioners ignored the assigned treatment of a post-free composite buildup and placed a post instead. The practitioners apparently considered these high-risk cases. The effect of this deviation from protocol would be to increase the apparent survival rate of the post-free group by excluding cases more prone to failure. These cases led the principal investigator also to take note of the study's inability to monitor the reasons potential participants were excluded from the study. As a result, it is unknown how many patients who were acceptable for participation as defined by the protocols were excluded by practitioners.

Conclusions: The type of post and core used was not relevant with respect to survival. The amount of remaining dentin height after preparation influenced the longevity of a post-and-core restoration.

COMMENTARY

The study as designed was very strong. Protocols were well defined in advance, and extensive effort was put into assuring that all operators were knowledgeable about the protocols, the treatment techniques, and the materials to be used. Treatment was randomly assigned. Failure criteria were defined in advance. Comparison groups were reasonable and defined in advance. These set up clear comparisons of the three build-up techniques and the two levels of remaining dentin height. These were comparisons of clinically relevant and important factors. There was, however, no blinding of the evaluators.

At present, practice-based research is of great interest. The reasoning is that this type of research has more relevance to the experiences of practitioners. Academic-based research is criticized for being too exacting. Here, it is said, restorations are placed with an eye towards achieving excellence, and the time requirements make the research less relevant to dental practice. The principal investigator in the present study discussed another, perhaps more important, difference between the two types of research. He believed university-based research is more amenable to internal controls. It has fewer operators, and it is easier to assure compliance with the protocols. Practice-based

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research has more operators, operators have considerable independence, and it is not possible to monitor compliance with the protocols very well.

This study attempted to combine the advantages of the two types of research. It also sought to minimize the disadvantages by using models to asses remaining dentin height, by performing a quality assurance assessment of a random sample of patient records, and by conducting clinical evaluations at random to confirm the results of evaluations made by the practitioner independently. Despite this extraordinary amount of diligence, the study as designed and as completed were not the same.

In an academic-based study, participants are advised about the risks of failures and apprised of the remedies provided by the study. They give consent with full knowledge of the risks. As stated earlier, the practitioner's focus is on providing successful treatment at a reasonable fee. Practitioners are accustomed to being the person the patient holds accountable for failures. Accordingly, it is difficult for a practitioner to provide a service he/she does not believe will be successful. In the present study, I would surmise that the practitioners who chose to place a post when none was called for did so because they did not believe the case would be successful without a post. As a result the protocol became a nonfactor. This is, in my opinion, an inherent weakness of practice-based research. For any given treatment, a study involving hundreds of dentists can very quickly generate very large numbers of successes and failures. As discussed with the previous retrospective studies, large numbers of observations do not necessarily equate with quality. As we have also seen previously, comparing the effectiveness of several treatment groups when many different methods were used to restore the tooth is not likely to yield any meaningful result. The same holds true when research is conducted without a set protocol or operators simply choose to disregard the protocol when it is not to their liking. Practice-based research networks consisting of hundreds of dentists where little or no supervision is possible only magnify the difficulty of providing internal controls several fold.

Even with its much smaller number of operators, the present study is an excellent example of just that. Overt instances of simply ignoring the protocol were reported. One also has to wonder about more subtle circumvention of the protocols. A practitioner who routinely uses posts in all endodontically treated teeth might have serious doubts as to whether the post-free treatment option can be successful. Assume that such a practitioner found restoring a particular tooth with a post-free composite core as simply unacceptable. Rather than risk random assignment to the post-free group, it would be quite easy to proclaim the tooth was not eligible for the study. Whether or how many times practitioners excluded otherwise eligible participants out of such a concern is simply unknown, but the author recognizes that the study had no way to evaluate who was excluded.

In summary, the present study, as designed, was strong and the results should provide high-quality evidence that the type of buildup used was not a significant factor whereas the amount of remaining dentin height was. The study as conducted is another matter. It is very difficult to assess the degree to which the failures to follow protocol, both those reported and unknown, affected the results. The most likely result would be exclusion of the more difficult cases. This means that these patients as a group were more likely to have success. Thus the results of the study may overestimate the efficacy of the three techniques generally, and those of the post-free group in particular.

SUGGESTED READINGS

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THE BOTTOM LINE

- The strength and reliability of the evidence provided by a study in support of one treatment over another are determined by the study design. The double-blind randomized clinical trial (RCT) that includes a control group is the gold standard for clinical biomedical research. As seen in the studies reviewed, when some or all of the elements of the RCT are missing, the evidence provided is much weaker. Accordingly, the practitioner should not rely on it with total confidence and should be open to changing his/her opinion when higher-quality evidence becomes available.
- This Critical Appraisal focuses on the design used and is not intended as a criticism of the individual studies. The profession would be better served if more RCTs were conducted, but they are expensive and time-consuming. Given the present dearth of RCTs, if practitioners were forced to await the results of RCTs before treating patients, the public would be poorly served. Studies such as the ones reviewed fill a void and offer the practitioner value. One simply needs to be aware of their limitations.
- In high-quality research, the protocol standardizes treatments in such a way that the groups being compared differ on only one or two important factors. Where treatment methods are highly varied, it is unreasonable to dismiss as having played no role in the success or failure of the case, all factors other than the one upon which the author has focused.
- Approaches to research that focus on accumulating large numbers of observations, but do not provide standardization of protocols are problematic. As we have seen in this review, numbers of subjects, teeth, etc., alone do not determine the strength of a study. One needs to look deeper and determine the quality of the data collected.
- Bias is always a concern. We all have personal beliefs about which treatments are best, and it is natural to be enthusiastic about treatments in which we believe. Study design should limit the ability of bias to impact results. The reader should be suspicious of personal bias where the conclusions are not supported by the data or go beyond the scope of the study. Bias is also exemplified by general enthusiasm towards a particular treatment method when it is not supported by the data.
- Of the four clinical studies included in the appraisal and the four noted as suggested reading, none found any significant difference in outcomes between the posts studied. Instead, this review provides strong evidence that the amount of remaining dentin height has a significant impact on survival.
- This review provides good evidence that there is no significant difference in survival rates between a cast post and core, a direct post and composite core, and a post-free composite core.
- This review also provides some evidence that dowel length is an important predictor of success.

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